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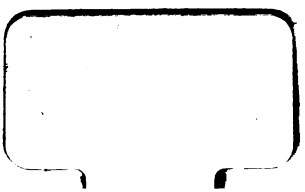

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Series I 1908

Barge Canal Bulletin

DEPARTMENT OF

THE STATE ENGINEER AND SURVEYOR

OF THE

STATE OF NEW YORK

FREDERICK SKENE, State Engineer and Surveyor

A Monthly Publication issued under the authority of the State Engineer, by the Bureau of Publication and Reports, Department of the State Engineer and Surveyor

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FEBRUARY, 1908

Barge Canal Bulletin

No. 1

DEPARTMENT OF

THE STATE ENGINEER AND SURVEYOR

OF THE

STATE OF NEW YORK

FREDERICK SKENE, State Engineer and Surveyor

ISSUED MONTHLY UNDER THE AUTHORITY OF THE STATE ENGINEER, BY THE BUREAU OF PUBLICATION AND REPORTS, DEPARTMENT OF THE STATE ENGINEER AND SURVEYOR

Work of Construction.

The Legislature of 1903 enacted a law (chapter 147), which, after approval by the people of the state at the ensuing general election, authorized the enlargement of the Erie, Champlain and Oswego canals to certain specified dimensions — an undertaking generally known as the "Barge canal." Within a short time after the ratification of this referendum the work of organizing an engineering force and of making surveys and plans was begun. In December, 1904, the first bids were opened, but owing to legal complications the contracts were not entered into until April and May of the following year. The first actual work of construction was performed on April 24, 1905, at Fort Miller, in opening a temporary canal on the Champlain. The first work on the main channel was done at Waterford, Erie canal, June 7, 1905.

In the following table there is given a summary of all work done in constructing the Barge canal to February 1, 1908. In order to limit the table to a reasonable size, items of a somewhat similar character are grouped under one heading.

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Total Amount of All Kinds of Construction Work, to February 1, 1908.

Similar kinds of work are grouped under one heading; an enumeration of the items grouped is shown in the foot-notes.

Contract Number.	Excavation.*a*	Embankment.*b*	Concrete.*c*	Dry stone work.*d*	Sawed lumber.*e*	Round timber.	Piles.	Iron and steel.*f*	Iron and steel.*g*	Miscellaneous items of work.*h*	Miscellaneous construction items.*i*	Extra and unspecified work.*j*	Extra and unspecified work.*k.*
	Cu. yds.	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*	*Ft. B. M.*	*Lin. ft.*	*Number.*	*Lbs.*					
1	524,311	11,764	3,574	3,437	23,307	38,857	0	0	0	$288	0	0	0
2	360,020	17,117	51,797	0	25,023	0	1,488	226,329	$1,290	14,608	$3,094	0	$1,316
3	761,373	96,814	28,955	3,550	30,781	0	16	166,455	0	6,149	668	0	36,044
4	1,035,432	19,030	1,566	6,270	533,516	106,983	2,571	35,943	0	11,848	0	0	1,257
5	901,601	10,649	1,770	518	56,457	0	36	0	0	2,862	153	0	0
6	1,061,022	28,899	498	0	0	0	0	0	0	560	0	0	0
7	0	0	93	2	37,737	0	0	738,036	0	0	838	0	0
8	117,486	3,500	7,281	0	24,750	0	3,372	14,123	462	200	0	0	0
10	100,816	0	2,180	446	57,500	0	0	0	0	0	0	0	0
11	248,175	54,614	18,282	2,243	178,595	0	308	125,189	0	1,080	1,210	0	0
14	19,680	0	0	0	0	0	0	0	0	0	0	0	0
15	565,960	1,736	1,105	0	24,901	0	2,453	2,029	0	192	0	0	0
17	40,964	1,615	1,322	2,321	4,348	0	373	11,811	0	200	573	0	0
18	137,487	62,862	7,681	292	969	0	136	16,269	0	125	0	$8,410	0
19	178,955	0	0	0	0	0	0	0	0	0	0	0	0
25	484,816	0	0	0	0	0	0	0	0	756	0	0	0
27	239,724	0	0	0	36,000	0	0	0	0	276	0	0	0
34	0	0	0	0	0	0	0	337,593	0	0	156	0	0
35	3,000	0	0	0	0	0	0	0	0	0	0	0	0
Totals	6,780,822	308,600	126,104	19,079	1,033,884	145,840	10,753	1,673,777	$1,752	$39,144	$6,692	$8,410	$38,617

a Includes earth and rock excavation and grubbing. *b* Includes embankment and puddle. *c* Includes concrete (all classes) and grouted filling. *d* Includes ballast, dry retaining wall, lining, riprap and stone filling in cribs. *e* Includes sawed lumber (all kinds), wooden sheet-piling and sheeting and bracing. *f* Includes chains, iron castings (plain or machined), iron pipe and specials, metal reinforcement, steel and iron fastenings, steel castings, structural steel and wrought iron. *g* Includes items paid for by the piece—fender fastenings, gate-hoists, lock-gates, needle-dams, valves, valve-seats and valve-supports. *h* Includes bailing and draining, clearing, extra labor on forms and finishing concrete, maintaining traffic, overhaul and removing revetment. *i* Includes channeling, cut stone work, iron railings, paving (all kinds), removing existing structures, repairs to local sewers, etc., sidewalks and curbs, steel sheet-piling, trenching and backfilling, vitrified pipe and wooden fencing. *j* At contract prices. *k* At cost, plus a fixed percentage.

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Comparison of Excavation on the Barge and Panama Canals.

A comparison of the amounts excavated on the two great canals now being built under State and Federal authority sets forth some interesting statistics. The work of excavation on the Panama canal, under American occupation, began in May, 1904; that on the Barge canal began in May, 1905. Thus it will be seen that the Panama is just one year in advance of the Barge canal. The appended table will show that during the first calendar year of work on the Panama canal (May, 1904, to January 1, 1905) there were excavated 243,472 cubic yards of material, while on the Barge canal during the first calendar year of work (May, 1905, to January 1, 1906) the excavation amounted to 716,676 cubic yards. During the second year the yardage credited to the Panama is 1,799,227, while it amounted to 1,460,705 on the Barge canal. In the third year 4,948,497 cubic yards were excavated on the Isthmus and 4,500,459 cubic yards on New York's canal enlargement. During the fourth year 15,764,095 cubic yards have been taken out at Panama, but the corresponding year for the Barge enterprise begins with January 1, 1908. These figures may be compared more readily in the following table:

	Panama Canal.* Cu. yds.	Barge Canal. Cu. yds.
First year of work.....	243,472	716,676
Second year of work....	1,799,227	1,460,705
Third year of work....	4,948,497	4,500,459
Fourth year of work....	15,764,095	Begins Jan. 1, 1908

In making these comparisons it must not be forgotten that the Panama canal is very largely a work of excavation, with relatively few structures, while the structures of the Barge canal are numerous and form a large portion of the undertaking, the excavation being only about forty per cent of the whole cost. It must be borne in mind also that the work at Panama is not so greatly affected by the changes of season as is that on the Barge canal, where during the four or five winter months operations are greatly impeded, and in many instances entirely discontinued.

In this connection it is interesting to notice that of the 4,500,495 cubic yards excavated in 1907, 4,041,140 cubic yards, or 90

* Figures from *The Canal Record*, Vol. I, p. 149, issue of January 8, 1908.

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per cent, were taken out during the seven months from May to November, inclusive. The average for these seven months was 577,306 cubic yards. Prior to the fourth year of work, the largest amount of material excavated on the Panama canal during any one month was in October, 1906, being 538,254 cubic yards, or 93 per cent of the average for the seven working months in New York. Again, the largest monthly excavation on the Barge canal occurred in August, 1907, amounting to 690,326 cubic yards, or 128 per cent of the largest monthly record during the third year at Panama.

The total amount of excavation on the Barge canal from the beginning of work to the end of 1907 is given by months in the following table, the classification of earth and rock being shown:

RECORD OF EXCAVATION, BARGE CANAL—MONTHLY TOTALS.

Month.	EXCAVATION IN CUBIC YARDS.		
	Earth.	Rock.	All excavation.
1905.			
May	6,890	6,282	13,172
June	31,705	2,253	33,958
July	54,065	5,705	59,770
August	108,090	10,013	118,103
September	120,610	12,200	132,810
October	145,345	20,836	166,181
November	65,161	51,265	116,426
December	40,076	36,180	76,256
Total	571,942	144,734	716,676
1906.			
January	26,707	41,776	68,483
February	27,158	23,956	51,114
March	28,694	26,064	54,758
April	25,131	22,712	47,843
May	76,775	33,114	109,889
June	98,080	28,164	126,244
July	86,669	24,176	110,845
August	114,158	37,440	151,598
September	129,944	41,867	171,811
October	174,896	40,292	215,188
November	248,156	41,936	290,092
December	45,816	17,024	62,840
Total	1,082,184	378,521	1,460,705
1907.			
January	5,202	10,873	16,075
February	1,386	14,573	15,959
March	12,517	28,099	40,616
April	196,802	31,801	228,603
May	390,116	43,229	433,345
June	446,050	44,942	490,992
July	544,557	88,280	632,837
August	605,196	85,130	690,326
September	529,210	53,354	582,564
October	564,922	73,455	638,377
November	515,866	56,833	572,699
December	113,107	44,959	158,066
Total	3,924,931	575,528	4,500,459

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Progress of Work.

The following table shows the cost of work done to February 1, 1908, on the several pieces of work under contract, together with the amounts done during January, 1908, and the whole percentage of work performed:

Contract No.	CONTRACTOR.	TOTAL VALUE OF WORK.			
		Put under contract.	Done to February 1, 1908.	Done during January, 1908.	Percentage of work done to February 1, 1908.
1	Empire Engineering Corporation..	*$605,008	$338,690	0	56.0
2	The Ferguson Contracting Co.....	*902,145	468,110	$8,640	51.8
3	Sundstrom & Stratton	*677,019	528,560	1,510	78.0
4	Empire Engineering Corporation..	*725,065	214,990	1,110	29.7
5	Empire Engineering Corporation..	*375,872	125,820	0	33.5
6	Frank A. Maselli.....	*1,022,601	497,350	5,360	48.6
7	Groton Bridge Company.....	*97,537	37,800	2,940	38.8
8	Pittsburg-Eastern Company.....	*1,434,755	146,390	750	10.2
10	Mosier & Summers.....	*1,107,610	103,550	6,980	9.4
11	Fort Orange Construction Comp'y.	1,359,475	235,260	7,330	17.3
12	Stewart-Kerbaugh-Shanley Co....	3,391,716	0	0	0
14	Acme Engineering and Contracting Company.....	2,935,763	14,460	3,750	0.5
15	Atlantic, Gulf & Pacific Company.	*1,520,547	180,260	2,810	11.8
16	United Construction Company ..	63,473	0	0	0
17	The Scofield Company.....	*836,643	57,560	0	6.7
18	O'Brien & Hoolihan Contracting Company.....	*861,599	130,490	17,280	15.2
19	Great Lakes Construction Co.....	1,000,497	51,190	490	5.1
25	Atlantic, Gulf & Pacific Company.	1,717,849	112,320	490	6.5
27	Kinser Construction Company...	*943,542	64,210	4,200	6.6
34	M. Fitzgerald	*22,449	15,340	800	68.0
35	Gilmour-Horton-Allen Company..	739,261	3,430	3,430	0.5
	Total.....	$22,340,426	$3,325,780	$67,870	

* *Includes all alterations in force to date.*

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Organization and Detailed Progress of Work.

In organizing the work of constructing the Barge canal, the whole extent was divided into three divisions, which in turn were separated into residencies, and these several residencies were likewise subdivided into contracts of suitable size for letting to contractors for performing the work of construction. In the following pages there is given the detailed account of these divisions and subdivisions, together with statements showing the condition of construction work, on February 1, 1908, on such portions as are under contract, and also the progress made in perfecting plans for the remaining portions.

CANAL BOARD.

The Canal Board, consisting of Lewis Stuyvesant Chanler, Lieutenant-Governor; John S. Whalen, Secretary of State; Martin H. Glynn, Comptroller; Julius Hauser, State Treasurer; William S. Jackson, Attorney-General; Frederick C. Stevens, Superintendent of Public Works, and Frederick Skene, State Engineer and Surveyor, approves all plans for the construction of the Barge canal.

OFFICE OF STATE ENGINEER.

Frederick Skene, State Engineer.
Charles H. O'Neill, Confidential Deputy.
Irving J. Morris, Chief Clerk.

OFFICE OF SPECIAL DEPUTY STATE ENGINEER.

William R. Hill, Special Deputy State Engineer, in direct charge of making surveys and plans and supervising construction.
William B. Landreth, Special Resident Engineer.

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ADVISORY BOARD OF CONSULTING ENGINEERS.

Edward A. Bond, Chairman.
Albert B. Fry.
Thomas W. Symons.
William A. Brackenridge.
Mortimer G. Barnes.

ENGINEERS' OFFICE.

Comprises the following bureaus:

General Drafting.— H. D. Alexander, Resident Engineer, in charge.

Bureau of Bridges.— William R. Davis, Chief Bridge Designer, in charge.

Bureau of River Improvement.— D. A. Watt, Expert Designer, in charge.

Bureau of Locks.— G. F. Stickney, Expert Lock Designer, in charge.

Bureau of Publication and Reports.— Noble E. Whitford, Resident Engineer, in charge.

Bureau of Hydraulics.— Robert E. Horton, Resident Engineer, in charge.

Bureau of Electrical Equipment.— George F. Chism, Resident Engineer, in charge.

Bureau of Computing and Checking.— F. M. Eames, Assistant Engineer, in charge.

Testing Laboratory.— Russell S. Greenman, Resident Engineer, in charge.

The three main divisions, called the Eastern, Middle and Western, comprise nearly the same divisions as have existed since the beginning of work on the original Erie and Champlain canals.

EASTERN DIVISION.

Louis B. Harrison, Division Engineer.

Extends from east line of New York State to Herkimer-Oneida Co. line. Embraces Erie residencies Nos. 1, 2, 3 and 4, and Champlain residencies Nos. 1, 2 and 3.

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Erie Residency No. 1.

C. A. Poole, Resident Engineer.

Extends from Hudson river at Troy to west end of Mohawk aqueduct at Cresent — 7.4 miles.

Includes contracts 2, 2A, 2B, 2C, 2D, 34, 11 and a portion of Nos. 7, 14, 16 and 33.

Contract No. 2.

E. Hilborn, in charge.

For prism excavation, and construction from Mohawk river at Waterford west, including Locks 2 and 3, to a point about one-fourth mile west of the latter. Length, .91 mile. Engineer's estimate, $1,022,640. Contractor's bid, $852,330. Date of contract, April 3, 1905. Date to be completed, July 1, 1907, extended to November 1, 1908. Contractors, Ferguson Contracting Co.

Part of the excavation below Lock No. 2 to the river has been done. On Lock No. 2 excavation for the west wall has been made and part of the concrete wall built. A large part of the concrete approach walls between the locks has been built. Most of the excavation between the locks is done, but not much west of Lock No. 3. Concreting and all progressive work stopped January 17, for the winter. Percentage completed to February 1, 1908, 51.8.

Contracts 2A, 2B, 2C, *and* 2D.

For removing buildings, and are unimportant, the first two being completed and the last two being now incorporated in Contract No. 2.

Contract No. 34.

E. Hilborn, in charge.

For steel highway bridge over Erie canal at Waterford. Type, pony truss, Warren bracing, curved upper chord. Span, 121 feet. Engineer's estimate, $22,604. Contractor's bid, $20,612. Date of contract, August 8, 1906. Date to be completed, January 1, 1907, extended to May 31, 1907, and again extended by reason of delay in having masonry substructures ready.

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False work began on April 18, 1907. The first steel was placed May 13, 1907, and by the first week in August all the steel was in place ready for riveting. The superstructure is now substantially completed, and, except for the flooring, would be ready for traffic. Sixty-eight per cent of the contract was estimated as completed on February 1, 1908.

Contract No. 11.

E. J. Becker, in charge.

For prism excavation, and construction from Station 220 — the west end of Contract No. 2 — to the Mohawk river below Crescent, including Locks 4, 5 and 6, highway, bridge and guard-gate masonry, etc.— 1.6 miles. Engineer's estimate, $1,671,385. Contractor's bid, $1,359,475. Date of contract, May 21, 1906. Date to be completed, October 1, 1909. Contractor, Fort Orange Construction Co.

All piling, nearly all of the highway from the foot of Lock No. 4 to head of Lock No. 6, about half of concrete core-wall on Lock No. 4, and half the concreting on Lock No. 5, is done. Also a large part of the prism excavated at Lock No. 6. The steam shovels in January excavated 13,000 cubic yards of material, and the rock channeler faced 4,500 square feet of surface. Both operations were much delayed by cold weather. Seventeen and three-tenths per cent of all work was completed on February 1, 1908.

Contract No. 7.

For twelve steel highway bridges at various points on Contracts Nos. 2, 3, 4, 5 and 6. Engineer's estimate, $102,123. Contractor's bid, $97,635. Date of contract, August 10, 1906. Date to be completed, July 1, 1907, and since extended. Contractors, Groton Bridge Co.

The following bridges are substantially completed: Fort Miller, Ridge Road and Paynes (on Contract No. 3), Spier's Road (on Contract No. 6). The Waterford bridge (on Contract No. 2) is complete except pavement and sidewalks. On Contract No. 4, Sylvan Beach bridge, steel all delivered and 24 per cent in place ready for riveting. Changes in plans on Contract No. 4 have delayed work on the other two bridges. On Contract No. 5, steel for

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the Mosquito Point bridge is being fabricated and timber for false work being delivered. On Contract No. 6, material for Buffalo, Lyell and Lee road bridges is at mills awaiting further progress on the contract. Thirty-eight and eight-tenths per cent of Contract No. 7 was completed February 1, 1908.

Contract No. 16.

For eleven steel highway bridges, ten of which are at various points on Contracts Nos. 25 and 27, Champlain canal. Engineer's estimate, $70,718. Contractor's bid, $63,472. Date of contract, December 20, 1906. Date to be completed, January 1, 1909. Contractors, United Construction Co.

The material has been ordered but work on several of these bridges will be delayed by reason of changes of plans on Contracts Nos. 25 and 27.

Contract No. 14.

E. J. Pickwick, Resident Engineer, in charge.

For dredging Mohawk river channel from west end of Contract No. 11 to a point near Rexford Flats aqueduct, constructing Locks Nos. 7, 13, 14 and 15, Dams Nos. 2, 3, 9, 10 and 11, Mindenville retaining dam, etc. Length, 15 miles. Engineer's estimate, $2,875,570. Contractor's bid, $2,935,763. Date of contract, September 10, 1907. Date to be completed, April 1, 1912. Contractor, Arthur W. Luce. Assignee, Acme Engineering Co.

The contractors are employed at present in the accumulation and installation of a working plant at Vischer's Ferry, in addition to which a steam shovel has thrown out 19,000 cubic yards of earth to February 1. At Fort Plain — Lock No. 15 — a traveling excavator is being erected. Five-tenths per cent of the contract has been done.

Erie Residency No. 2.

C. A. Poole, Resident Engineer.

Extends from west end of Mohawk aqueduct at Crescent to 1.2 miles west of Crane's Village at old Lock No. 27 — 32.8 miles.

Includes Contracts Nos. 8, 20 and part of 14.

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Contract No. 8.

C. H. MacCulloch, Resident Engineer, in charge.

For constructing Dam No. 4 and Lock No. 8, at Scotia; Dam No. 5 and Lock No. 9, at Rotterdam; Dam No. 6 and Lock No. 10, at Crane's Village, all on the Mohawk river. Contract length, 0.7 mile. Engineer's estimate, $1,518,382. Contractor's bid, $1,433,817. Date of contract, May 22, 1906. Date to be completed, July 1, 1910. Contractors, Eastern Contract Co. Assignee, Pittsburg-Eastern Co.

Lock No. 9 and approach wall at Rotterdam are 55 per cent excavated. Ten per cent of foundation piles are driven. Work stopped January 10 by ice. At the Crane's Village dam (No. 6), 30 per cent of the excavation is completed and 45 per cent of piles driven. At lock No. 10, and approach walls, adjacent, 95 per cent of the excavation, 20 per cent of the embankment, 75 per cent of the foundation piles and 30 per cent of the concrete complete. Work was stopped by the breaking of a coffer-dam in the latter part of November, 1907. On account of near approach of winter, contractor decided not to renew operations till spring.

On the entire contract (No. 8), 10.2 per cent is completed.

Contract No. 20.

O. F. Bellows, in charge.

For dredging Mohawk river channel and for stream entrances between Rexford Flats and Mindenville. Length, 53.7 miles. Engineer's estimate, $3,480,449. Plans completed and before the Canal Board for action.

ERIE RESIDENCY No. 3.

F. P. Williams, Resident Engineer.

Extends from west end of Erie Residency No. 2, near Crane's Village, to Mindenville — 35.6 miles.

Includes Contracts Nos. 17, 28 and part of 14.

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Contract No. 17.

M. E. James, in charge, Dam No. 7.

A. E. Steere, in charge, Dam No. 8.

For constructing Dam No. 7 and Lock No. 11 at Amsterdam, and Dam No. 8 and Lock No. 12 at Tribes Hill. Contract length, 4 miles. Engineer's estimate, $883,926. Contractor's bid, $835,-725. Date of contract, December 29, 1906. Date to be completed, January 1, 1910. Contractors, The Scofield Co.

At Amsterdam, the abutment for Dam No. 7 is nearly completed and the excavation for Lock No. 11 has been begun. At Tribes Hill most of the piles for abutment for Dam No. 8 have been driven and sixty-five feet of adjacent excavation for dam has been practically completed. Excavation on Lock No. 12 has been commenced. The contractors failed in September last. The State subsequently did a small amount of work to protect the work already done. The contract is now ready for reletting.

Contract No. 28.

(Combined with Contract No. 20.)

ERIE RESIDENCY No. 4.

S. M. Savage, Resident Engineer.

Extends from Mindenville to Herkimer-Oneida Co. line — 30.6 miles.

Includes Contracts Nos. 18, 29, 31 and part of No. 30.

Contract No. 18.

G. I. Oakley, in charge.

For prism excavation from Mindenville to Castle Creek; construction of Lock No. 16, dam at Castle Creek, and incidental structures. Length, 3.63 miles. Engineer's estimate, $789,440. Contractor's bid, $859.460. Date of contract, December 28, 1906. Date to be completed, December 20, 1910. Contractors, O'Brien & Hoolihan Contracting Co.

The temporary canal at Mindenville was completed for use April 24, 1907. The upper guide-walls for Lock No. 16 are com-

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plete and work is progressing on the main lock walls. Bridge abutments have been started and 15.2 per cent of the contract completed.

Contract No. 29.

For prism excavation at Little Falls, constructing Lock No. 17 and Rocky Rift dam. Length, 1.02 miles. Combined with Contract No. 31.

Contract No. 31.

For prism excavation, Jacksonburg to Herkimer, lock at Jacksonburg, guard-gate at Herkimer, bridges, etc. Length, 4.22 miles.

Contracts Nos. 29 and 31 are now combined and the plans are practically completed.

Contract No. 30.

For dredging Mohawk river channel and constructing movable dams at Utica and Herkimer, lock at Sterling Creek, stream entrances, etc., from Indian Castle to near Utica, except lengths covered by Contracts Nos. 29 and 31. Contract length, 21.6 miles. Two and two-tenths miles of this contract are within the limits of Erie Residency No. 5. Plans 60 per cent complete.

CHAMPLAIN RESIDENCY No. 1.

E. V. R. Payne, Resident Engineer.

Extends from Barge canal junction at Waterford to old Lock No. 10, near Northumberland dam. No contract numbers have yet been assigned to this residency.

CHAMPLAIN RESIDENCY No. 2.

E. V. R. Payne, Resident Engineer.

Extends from foot of old Lock No. 10, near Northumberland dam, to Dunham's Basin, including Glens Falls feeder, dam and pond.

Includes Contracts Nos. 1, 3, 3A, 24, 26, 27 and part of No. 7.

Contract No. 1.

H. Shoemaker, Assistant Engineer, in charge.

For dredging Hudson river channel from Northumberland to

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Fort Miller and from Crocker's Reef to Fort Edward; construction of Crocker's Reef dam and approaches to "The Land Line," etc. Length, 7.075 miles. Engineer's estimate, $619,846. Contractor's bid, $605,008. Date of contract, April 18, 1905. Date to be completed, March 15, 1908. Contractor, Lindon W. Bates. Assignee, Empire Engineering Corporation.

On Contract No. 1, 80 per cent of the channel excavation above Crocker's Reef is completed. The dam and the timber part of breakwater pier at that point are also complete. On the approaches to land line the earth has been stripped from the rock and drilling for rock removal is in progress. Fifty-six per cent of the entire contract is completed.

Contract No. 3.

L. C. Hulburd, Resident Engineer, in charge.

For prism excavation from Fort Miller to Crocker's Reef; construction of Lock No. 6, guard-gate and bridge foundations, removal and reërection of East street bridge, relocation of old Champlain canal and incidental work. Length, 2.164 miles. Engineer's estimate, $760,576. Contractor's bid, $670,497. Date of contract, April 4, 1905. Date to be completed, April 15, 1907, extended to December 1, 1908. Contractors, Sundstrom and Stratton.

The canal excavation is nearly complete. The temporary canal has been in operation during the season. The bridges and approaches are practically complete. Excavation for the guard-gates is partly completed and the retaining wall north of this is finished. Lock No. 6 is complete, including lower approaches, as far as the upper gate-recess. The adjacent turnpike has been relocated and rebuilt. Work on this contract was suspended for the winter January 20, at which time 78 per cent was done.

Contract No. 3A.

For removal of buildings, etc. Unimportant and practically completed.

Contract No. 24.

For guard-gate structures at Crocker's Reef dam. Engineer's estimate, $61,900. Plans completed ready for Advisory Board.

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Contract No. 26.

For dredging Hudson river channel between Fort Edward and north end of Contract No. 1. Length, 0.76 mile. Plans approved by Canal Board ready for letting.

Contract No. 27.

S. Belding, Assistant Engineer, in charge.

For prism excavation, construction of Locks Nos. 7 and 8, and junction lock, spillways, power plants, and concrete arch bridge, etc., between Dunham's Basin road and Fort Edward. Length, 3.76 miles. Engineer's estimate, $998,920. Contractor's bid, $972,210. Contractors, Kinser Construction Co.

Earth excavations at Lock No. 8 complete and north of Lock No. 8 about 75 per cent done. About 60 per cent of junction lock pile foundation driven and piles delivered at Lock No. 7.

CHAMPLAIN RESIDENCY No. 3.

F. C. Davis, Resident Engineer.

Extends from highway crossing at Dunham's Basin to deep water, Lake Champlain, at Whitehall — 19.8 miles.

Includes Contracts Nos. 15, 25 and part of No. 16.

Contract No. 25.

D. B. La Du, in charge.

For prism excavation, and construction of Lock No. 9 (9 and 10 combined), spillways, power plants, bridge and other structures between 0.6 mile north of Comstock post-office and highway crossing at Dunham's Basin. Length, 13 miles. Engineer's estimate, $1,849,831. Contractor's bid, $1,754,236. Date of contract, November 19, 1906. Date to be completed, March 1, 1911. Contractors, Atlantic, Gulf and Pacific Co.

Excavating near Fort Ann and levees southward built. Contract 6.5 per cent complete.

Contract No. 15.

D. B. La Du, in charge.

For prism excavation, and constructing Lock No. 11, Dam No. 4; Lock No. 12, Dam No. 5; spillway, culverts, highway,

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bridges and other structures between 0.6 mile north of Comstock post-office and Lake Champlain at Whitehall. Length, 6.8 miles. Engineer's estimate, $1,380,760. Contractor's bid, $1,509,060. Date of contract, August 9, 1906. Date to be completed, August 1, 1910. Contractor, Atlantic, Gulf and Pacific Co.

Levees north of Lock No. 11 are built and canal excavation is in progress. At Lock No. 11 excavation has been in progress and concreting on west wall begun. At Lock No. 12 excavation has also been in progress and concreting on east wall and adjacent upper approach wall begun. Percentage completed, 11.8.

MIDDLE DIVISION.

Henry B. Brewster, Division Engineer.

Extends from Herkimer-Oneida Co. line to west line of Savannah, Wayne Co.; also from Onondaga lake to Three River Poin and thence to Oswego.

Erie Residency No. 5.

F. J. Wagner, Resident Engineer.

Extends from Herkimer-Oneida Co. line to Oneida-Oswego Co. line, in Oneida lake — 38 miles, of which 7½ miles are in the lake.

Includes Contracts Nos. 42, 43, 44, 13, 4, 4A and a portion of Nos. 7 and 30.

Contract No. 42.

For prism excavation, and construction of Lock No. 20, stream entrances, spillway, bridge and other structures, between Station 5500, near Utica, and one-half mile east of Oriskany. Length, 4.6 miles. Engineer's estimate, $602,971. Plans now before the Canal Board.

Contract No. 43.

(Contracts Nos. 43, 44 and 13 now combined.)

The local controversy and later decisions as to location at Rome have delayed the completion of plans.

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Contract No. 4.

E. J. Berry, in charge.

From a point about four miles east of Sylvan Beach on Wood creek to Oneida lake, including bridge foundations at Burdick's, Robert's, N. Y. O and W. R. R., and Sylvan Beach, Drum creek and other stream entrances, crib and pile docking, breakwater and guard-pier in Oneida lake, etc. Length, 4.83 miles. Engineer's estimate, $812,560. Contractor's bid, $726,815. Date of contract, April 18, 1905. Date to be completed, November 15, 1907, — extended to May 15, 1909. Contractor, Lindon W. Bates. Assignee, Empire Engineering Corporation.

From Sylvan Beach for three miles east levees have been built and dredging almost complete. Bridge abutments are built, but one on each of two bridges will have to be rebuilt by reason of changed plans in form of prism. Crib docking at Sylvan Beach has been mostly constructed.

Contract No. 4A.

For removal of structures on Contract No. 4. Unimportant.

ERIE RESIDENCY No. 6.

Guy Moulton, Resident Engineer.

Extends from Oneida-Oswego Co. line in Oneida lake to west line of Baldwinsville, Onondaga Co.

Includes Contracts Nos. 45 and part of 12.

Contract No. 12.

For prism excavation, and construction of Lock No. 23, structures, bridges, abutments and approaches between west end of Oneida lake and Mosquito Point bridge on Seneca river. Length, 43.73 miles, 23 miles of which are in Residency No. 6. Engineer's estimate, $3,082,560. Contractor's bid, $3,391,716. Contractors, Stewart, Kerbaugh & Shanley Co.

Contractors assembling plant.

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Contract No. 45.

For constructing Lock No. 24, approaches, power plant, bridge substructure, and raising crest of Baldwinsville dam. Length, 0.8 mile. Plans ready for consideration by Canal Board.

ERIE RESIDENCY No. 7.

Guy Moulton, Resident Engineer.

Extends from west line of Baldwinsville, Onondaga Co., to west line of Savannah, Wayne Co.— 33 miles.

Includes Contract No. 5 and parts of 7 and 12.

Contract No. 5.

G. W. Stickney, in charge.

For prism excavation, construction of Owasco creek entrance, and bridge foundations at Mosquito Point, Sibley's, and Fox Ridge highway crossings, etc. Length, 5.66 miles. Engineer's estimate, $421,252. Contractor's bid, $381,987. Date of contract, April 18, 1905. Date to be completed, November 15, 1907. Contractor, Lindon W. Bates. Assignee, Empire Engineering Corporation.

The prism for two miles between Fox Ridge and Mosquito Point is completed. Beyond Fox Ridge a change of location has delayed construction. Bridge foundations have been built and Mosquito Point bridge raised.

OSWEGO RESIDENCY No. 1.

T. M. Ripley, Resident Engineer.

Extends from Three Rivers, Onondaga Co., to the limit of Residency No. 2, which is not yet fixed.

Includes Contracts Nos. 39, 38, 10, 37 and 36.

Contract No. 39.

For dredging channel in Oswego river, constructing stream entrances, excavating through Hinmansville cut-off, etc., between Phœnix and Oswego, except portions covered by Contracts Nos. 38, 10, 37 and 36. Plans 75 per cent done.

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Contract No. 10.

For prism excavation, constructing Locks Nos. 2 and 3, dams, bulkheads, etc., at Fulton. Length, 1.2 miles. Engineer's estimate, $1,149,988. Contractor's bid, $1,126,718. Date of contract, June 7, 1906. Date to be completed, July 1, 1909. Contractors, Mosier and Summers.

Excavation at north end of contract in progress. Excavation for Lock No. 2, half completed. Part of the concrete walls at the north end have been built.

Contract No. 37.

(Combined with Contract No. 38.)

For prism excavation, and constructing Locks Nos. 1, 4 and 5, and Dam No. 4, bulkhead and head-gates, guard-gates and dike, etc., near Minetto, movable crest on Dam No. 1, at Phœnix, and removing portion of existing dam at Battle Island. Length, 1.4 miles. Engineer's estimate, $793,300. Work on plans suspended, pending certain decisions.

Contract No. 36.

Definite description not at present available.

Oswego Residency No. 2.

E. Styring, Resident Engineer.

Limits of residency not yet fixed. Includes Contract No. 35.

Contract No. 35.

For prism excavation, and constructing Locks Nos. 7 and 8, bulkheads, culverts, spillways, etc., between a point one-half mile above Utica street bridge and harbor line north of Bridge street bridge at Oswego. Length, .85 mile. Engineer's estimate, $752,760. Contrator's bid, $739,261. Date of contract, September 16, 1907. Date to be completed, August 15, 1911. Contractors, Gilmour, Horton, Allen Co.

The coffer-dam at Lock No. 8 is being built. Excavation is in progress in prism south of Lock No. 8, and at two culverts. Steel for two bridges has been ordered.

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Bureau of Water-Supply.

R. R. Stuart, Engineer of Water-Supply.

This bureau has charge of the preparation of plans and estimates for Contracts Nos. 50, 51, 52, 55 and 58.

Water-Supply Residency.

W. H. Van Wie, Resident Engineer.

Contract No. 50.

For constructing a dam, waste-gates and spillway across West Canada creek at Hinckley. Plans under way.

Contract No. 51.

For constructing a diverting dam and feeder to Nine Mile creek watershed. Plans under way.

Contract No. 52.

For constructing a dam on Nine Mile creek, Oneida Co. Plans under way.

Contract No. 55.

For constructing a dam, waste-gates and spillway, four locks, Black River Canal aqueduct over Mohawk river, and relocation of Black River canal at Delta. Plans 90 per cent done.

Contract No. 58.

For constructing a dam, waste-gates and spillway across Limestone creek, at High Bridge, Onondaga Co. Plans under way.

WESTERN DIVISION.

John P. Kelly, Division Engineer.

Extends from west line of Savannah, Wayne Co., to west line of New York State, and embraces Erie Residencies Nos. 8, 9, 10A, 10B and 11.

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Erie Residency No. 8.

B. E. Failing, Resident Engineer.

Extends from west line of Savannah, Wayne Co., to Wayne-Monroe Co. line,— about 38 miles.

No contract sections have been assigned to this residency. Field and office work is in progress.

Erie Residency No. 9.

T. J. Morrison, Resident Engineer, in charge of contract work.

F. J. Wilbur, in charge of surveys and offices.

Extends from Wayne-Monroe Co. line to Monroe-Orleans Co. line.

Includes Contracts Nos. 23, 22, 21, 6, 6A, 60, 61 and part of 7.

Contract No. 23.

For prism excavation, constructing Locks Nos. 32 and 33 and appurtenant structures, culverts, bridge foundations, etc., between Kings Bend and the east bank of the Genesee river. Length, 5.6 miles. Plans 25 per cent done.

Contract No. 21.

Now combined with 22. For prism excavation, and constructing bridge foundations, etc., between point just north of Scottsville road and another point just north of Buffalo road and south of Rochester, dredging Genesee river, constructing guard-lock, guard-gate and controlling dam at Genesee river crossing. Field work on 21 is completed. Length, 2.5 miles.

Contract No. 6.

For prism excavation, and construction of five bridge foundations between point just south of Buffalo road and another point near South Greece and southwest of Rochester. Length, 3.28 miles. Engineer's estimate, $1,381,662. Contractor's bid, $1,005,982. Date of contract, May 3, 1905. Date to be completed, May 1, 1908. Contractor F. A. Maselli and Co. Assignee F. A. Maselli.

Excavation on western half of this contract is nearly completed and on the eastern half about one-quarter done. Excava-

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tion by bridge conveyer continued until 17th of January. Steam shovels not working. 11,600 cubic yards excavated during January. Abutments at Spier's Road bridge done and New York Central Railroad bridge — sub and superstructure — complete. Drainage pumps are in active operation. 48.6 per cent of contract completed.

Contract No. 6A.

For removal of buildings, etc. Unimportant.

Contract No. 60.

For prism excavation, and construction of culverts, bridge substructures, etc., between a point 1.75 miles east of South Greece and a point 0.5 mile west of Adam's Basin bridge. Length, 8.5 miles. Plans 90 per cent done.

Contract No. 61.

For prism excavation and construction of culverts, bridge substructures, etc., between a point 0.5 mile west of Adam's Basin bridge and Monroe-Orleans Co. line. Length, 7.4 miles. Plans well under way.

ERIE RESIDENCY No. 10A.

C. A. Ingersoll, Resident Engineer.
Extends from Orleans-Monroe Co. line to Gasport, 26 miles. Includes Contracts Nos. 62, 63, 9, 64 and 65.

Contract No. 62.

(Now combined with 63.)

For prism excavation, and construction of culverts, bridge substructures, etc., between Orleans-Monroe Co. line and a point near Eagle Harbor bridge. Length, 14.15 miles. Plans under way.

Contract No. 9.

For prism excavation, extending one culvert, constructing ten culverts, five bridges and their foundations and approaches, between a point near Eagle Harbor bridge and a point near Beal's bridge. Length, 5.682 miles. Engineer's estimate, $724,014.

Bids were opened on January 31, 1908. Contract not awarded and readvertised to be opened March 10, 1908.

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Contract No. 64.

With which is now combined Contract No. 65. For prism excavation, construction of bridge substructures and approaches, and canal aqueduct across Oak Orchard creek at Medina, from a point near Beal's bridge to 100 feet east of Gasport bridge. Combined length, 11.85 miles. Plans ready for approval of Canal Board.

ERIE RESIDENCY No. 10B.

T. W. Barrally, Resident Engineer.

Extends from near Gasport bridge to Sulphur Spring guard-lock — 11.7 miles.

Includes Contracts Nos. 66, 67 and 40.

Contract No. 66.

For prism excavation, constructing substructures and approaches for bridges, culverts, etc., from 100 feet east of Gasport bridge to foot of locks at Lockport. Length, 6.4 miles. Plans 90 per cent completed.

Contract No. 67.

For construction of Lock No. 34 and approaches, power plant, etc., at Lockport. Length, 0.6 mile. Plans 20 per cent done.

Contract No. 40.

For prism excavation, constructing substructures and approaches for bridges, etc., from head of locks at Lockport to Sulphur Spring guard-lock. Length, 4.7 miles. Plans under way.

ERIE RESIDENCY No. 11.

T. W. Barrally, Resident Engineer.

Extends from Sulphur Spring guard-lock to and through city of Buffalo.

Includes Contract No. 19.

Contract No. 19.

C. J. McDonough, in charge.

For prism excavation, rebuilding bridges, constructing masonry culvert, concrete-capped pile docking, etc., between Sulphur Spring guard-lock and mouth of Ellicott creek. Length, 12.46 miles. Dredging begun. Percentage of work to date, 5.1.

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MARCH, 1908

Barge Canal Bulletin

Series I No. 2

DEPARTMENT OF

THE STATE ENGINEER AND SURVEYOR

OF THE

STATE OF NEW YORK

FREDERICK SKENE, State Engineer and Surveyor

ISSUED MONTHLY UNDER THE AUTHORITY OF THE STATE ENGINEER, BY THE BUREAU OF PUBLICATION AND REPORTS, DEPARTMENT OF THE STATE ENGINEER AND SURVEYOR

General Progress of Work.

During the winter months the conditions in this northern climate are such that great progress in the work of constructing the Barge canal cannot be expected. The following pages will tell in detail what has been accomplished to March 1, 1908, and especially during the month of February. The work of preparing plans in the central and residency offices has been going on without abatement. The completed plans for several contracts have gone before the Advisory Board of Consulting Engineers for consideration, and some have received the approval of the Canal Board and are ready for advertising and letting.

Many of the contractors have been repairing or moving machinery, or installing additions to their plants. Some of them, who have done very little as yet on the actual work of construction, expect to have their plants ready for active operations with the opening of the spring.

In the following table there is given a summary of all work done in constructing the Barge canal to March 1, 1908.

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Total Amount of All Kinds of Construction Work, to March 1, 1908.

Similar kinds of work are grouped under one heading; an enumeration of the items grouped is shown in the foot-notes.

Contract Number.	Excavation.a	Embankment.b	Concrete.c	Dry stone work.d	Sawed lumber.e	Round timber.	Piles.	Iron and steel.f	Iron and steel.g	Miscellaneous items of work.h	Miscellaneous construction items.i	Extra and unspecified work.j	Extra and unspecified work.k
	Cu. yds.	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*	*Ft. B. M.*	*Lin. ft.*	*Number.*	*Lbs.*					
1.....	524,311	11,764	3,574	3,437	23,307	38,857	0	0	0	$288	0	0	0
2.....	360,020	17,117	51,797	0	25,023	0	1,488	226,329	$1,290	14,608	$3,094	0	$1,316
3.....	755,649	92,690	26,617	3,550	30,781	0	16	163,552	0	6,149	668	$3,713	36,044
4.....	1,035,432	19,030	1,566	6,927	548,504	106,375	2,571	35,943	0	11,848	0	0	1,257
5.....	901,601	10,649	1,770	518	56,457	0	36	0	0	2,862	153	0	0
6.....	1,071,572	28,899	498	0	0	0	0	0	0	560	0	0	0
7.....	0	0	93	2	37,737	0	0	865,784	0	0	838	0	0
8.....	117,486	3,500	7,281	0	24,750	0	3,372	14,123	462	200	0	0	0
10.....	100,816	0	2,180	446	57,500	0	0	0	0	0	0	0	0
11.....	258,771	54,614	18,282	2,243	178,595	0	308	125,189	0	1,080	1,628	0	0
14.....	19,830	0	0	0	0	0	0	0	0	30	0	0	0
15.....	567,470	1,736	1,105	0	24,901	0	2,453	2,029	0	240	0	0	0
17.....	40,964	1,615	1,322	2,321	4,348	0	373	11,811	0	200	573	0	0
18.....	150,539	70,490	7,742	292	969	0	136	16,269	0	200	0	8,410	0
19.....	178,955	0	0	0	0	0	0	0	0	0	0	0	0
25.....	484,816	0	0	0	0	0	0	0	0	994	0	0	0
27.....	239,724	0	0	0	66,418	0	0	0	0	276	0	0	0
34.....	0	0	0	0	0	0	0	345,013	0	0	340	0	0
35.....	3,200	0	0	0	0	0	0	0	0	0	0	0	0
Totals..	6,811,156	312,104	123,827	19,736	1,079,290	145,232	10,753	1,806,042	$1,752	$39,535	$7,294	$12,123	$38,617

a Includes earth and rock excavation and grubbing. *b* Includes embankment and puddle. *c* Includes concrete (all classes) and grouted filling. *d* Includes ballast, dry retaining wall, lining, riprap and stone filling in cribs. *e* Includes sawed lumber (all kinds), wooden sheet-piling and sheeting and bracing. *f* Includes chains, iron castings (plain or machined), iron pipe and specials, metal reinforcement, steel and iron fastenings, steel castings, structural steel and wrought iron. *g* Includes items paid for by the piece — fender fastenings, gate-hoists, lock-gates, needle-dams, valves, valve-seats and valve-supports. *h* Includes bailing and draining, clearing, extra labor on forms and finishing concrete, maintaining traffic, overhaul and removing revetment. *i* Includes channeling, cut stone work, iron railings, paving (all kinds), removing existing structures, repairs to local sewers, etc., sidewalks and curbs, steel sheet-piling, trenching and backfilling, vitrified pipe and wooden fencing. *j* At contract prices. *k* At cost, plus a fixed percentage.

Note:— Certain duplications occurring in the corresponding table of the February issue of the *Barge Canal Bulletin* are here corrected.

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Table of Progress.

The following table shows the cost of work done to March 1, 1908, on the several pieces of work under contract, together with the amounts done during February, 1908, and the whole percentage of work performed. It will be seen that little construction work has been performed during the month, owing chiefly to severe weather conditions. However, as will be related in the detailed account of each contract, many of the contractors have employed the time in repairing and increasing their plants, so as to be ready to begin operations at an early date.

Contract No.	CONTRACTOR.	Total Value of Work.			Percentage of work done to March 1, 1908.
		Put under contract.	Done to March 1, 1908.	Done during February, 1908.	
1	Empire Engineering Corporation..	*$605,008	$338,690	0	56.0
2	The Ferguson Contracting Company	*902,145	468,110	0	51.9
3	Sundstrom & Stratton	*657,273	511,170	0	77.8
4	Empire Engineering Corporation..	*725,065	216,710	$1,720	30.0
5	Empire Engineering Corporation..	*375,872	125,820	0	33.5
6	Frank A. Maselli	*1,022,601	502,230	4,880	49.2
7	Groton Bridge Company	*97,537	43,870	6,070	45.0
8	Pittsburg-Eastern Company	*1,434,755	146,390	0	10.2
10	Mosier & Summers	*1,107,610	103,550	0	9.4
11	Fort Orange Construction Company	1,359,475	241,080	5,820	17.8
12	Stewart - Kerbaugh - Shanley Company	3,391,716	0	0	0
14	Acme Engineering & Contracting Company	2,935,763	14,590	130	0.5
15	Atlantic, Gulf & Pacific Company.	*1,520,547	180,740	480	11.9
16	United Construction Company....	63,473	0	0	0
17	Alexander Murdock	*836,643	57,560	0	6.9
18	O'Brien & Hoolihan Contracting Company	*861,599	138,830	8,340	16.1
19	Great Lakes Construction Company	1,000,497	51,190	0	5.1
25	Altantic, Gulf & Pacific Company.	*1,717,849	112,550	230	6.5
27	Kinser Construction Company....	*943,542	65,430	1,220	6.9
34	M. Fitzgerald	*22,449	15,860	520	70.6
35	Gilmour-Horton-Allen Company..	739,261	3,660	230	0.5
	Totals	$22,320,680	$3,338,030	$29,640	

* Includes all alterations in force to date.

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Further Comparisons Between the Barge and Panama Canals.

In the last number of the *Barge Canal Bulletin* there appeared a comparison of the progress already made in excavation on the Panama and Barge canals. Further study of this subject has revealed some interesting facts.

Upon careful investigation there seemed to be a marked uniformity in the rate of increase in the amounts being excavated at Panama. By plotting the total quantities, by months, on logarithmic paper this uniformity appeared the more striking, especially since the beginning of the second year. As this method presents the conditions graphically and in such a manner that the eye may quickly grasp their significance, the diagram is here reproduced, so as to show the results of this plotting. The remarkable smoothness of the line labeled "Panama Canal" will be observed. The straight line, drawn to equalize the irregularities, represents the average rate of progress. The equation determined for this straight line is: $y = 1.54x^{0.315}$ in which y equals the time, in years, after January 1, 1904, and x represents the total amount of excavation, in millions of cubic yards.

For the sake of comparison, a line to represent the progress on the Barge canal was plotted on the same diagram. (It will be remembered that work on the Barge canal began just about a year after operations, under American occupation, at Panama.) A similarity of progress on the two enterprises is easily observable, the same average rate of acceleration serving for both. It will be seen that, while operations on the Barge canal are slow during the winter, a greater speed is attained during the summer, so that at the end of both the second and third years the total amounts excavated on the two undertakings were very nearly alike. At the close of last November, when work began to slow down on the Barge canal, the difference in total quantities was quite remarkable, being only 2,749 cubic yards,— an amount equal to about half of an average day's work for the hydraulic dredge operating on Contract No. 5. (This machine maintained an average of about fifty-three hundred cubic yards a day during four months in 1907, and at certain times it accomplished more than thrice that amount in a single day.)

When comparison of progress is made between the Panama and New York projects, it must be remembered that much work

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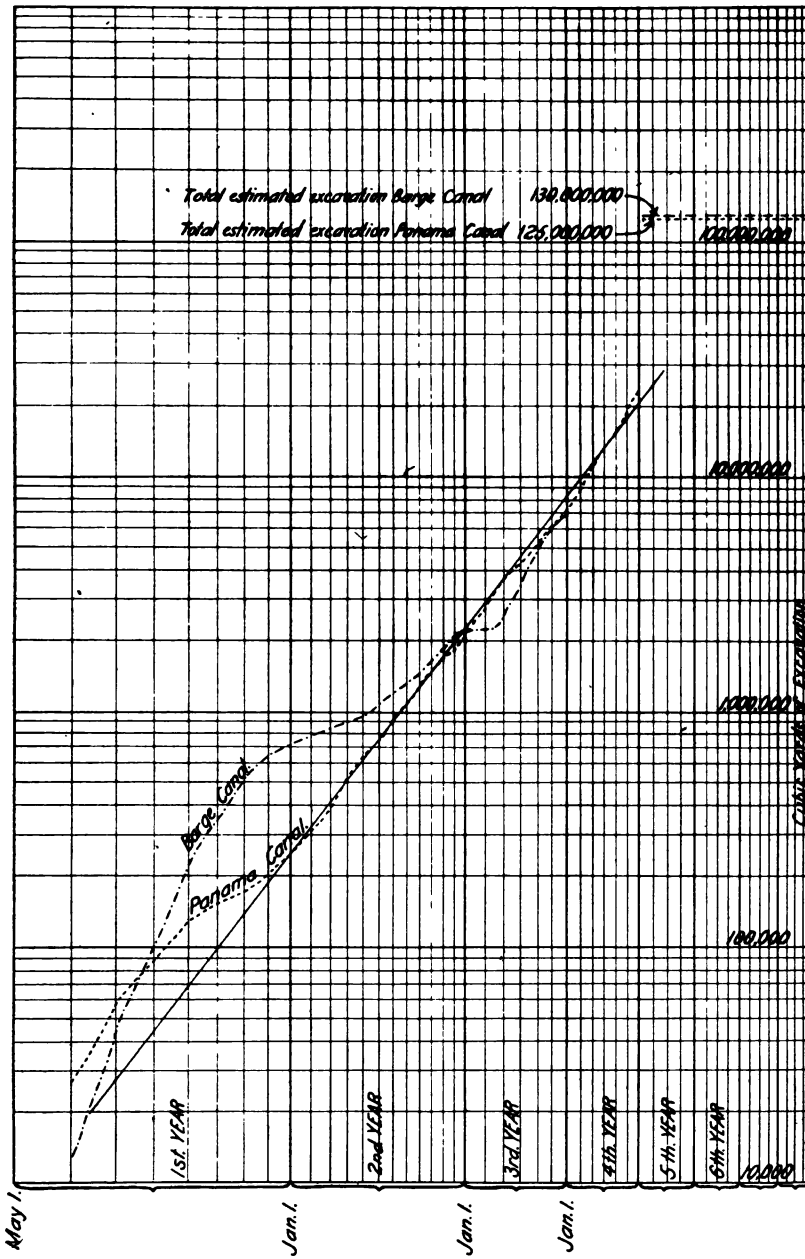
DIAGRAM SHOWING COMPARATIVE PROGRESS OF EXCAVATION OF PANAMA & BARGE CANALS.



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besides excavation has been done on the Barge canal. Since one-third of all payments to date has been for the building of structures, the total of all work accomplished on this enterprise amounts to 50 per cent more than is shown by the line on the diagram, which represents excavation alone. At Panama, on the other hand, little towards the actual construction of the canal has been done excepting in the way of excavation. At Panama, also, it will be observed, much of the excavation is concentrated in deep cuttings, where large accomplishments may naturally be expected, while the excavation on the Barge canal occurs in no single large amounts, but is somewhat evenly distributed in small quantities throughout the entire extent. These statements are not made in order to detract from the great achievements on the Isthmus, for it is well known, of course, that the Federal Government had a gigantic task in preparing the Canal Zone for habitation, so as to make possible the building of a canal, but the comparison is given simply to show that relatively the Barge canal has been quietly but surely making as rapid, or even more rapid progress.

As a means for studying what has been done thus far on these two canals, the diagram becomes interesting and instructive; as a basis for predicting future progress, it can be used only to indicate that, at this early stage of operations, a somewhat similar rate of acceleration may be expected for several months. Neither enterprise has yet reached its maximum speed; it is reported that the Isthmian Commission has ordered a large consignment of new excavating machinery, and several contractors on the Barge work have been installing large plants and will be able greatly to increase the total output during the working season of the present year. To observe the future relative progress of these two great undertakings will be a matter of much interest.

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Detailed Account of Contract Work for February.

An account of what was accomplished during February, 1908, on each piece of work under contract will be found in the following list, under its respective contract number. The order followed is one of location, similar to the list that appeared in the last number of the *Barge Canal Bulletin,* where the whole enumeration of existing and prospective contracts was set forth at length. Beginning at Waterford the pieces of work on the Erie canal are given in their order toward the west, with the contracts on the Champlain and Oswego canals, in order from south to north, inserted at the ends of the Erie contracts of the Eastern and Middle divisions, respectively.

Contract No. 2.

For prism excavation, and construction from Mohawk river at Waterford west, including Locks 2 and 3, to a point about one-fourth mile west of the latter.

No construction work done during February. Traffic opened on the Fourth street bridge on the 14th of the month. Percentage of work done, 51.9.

Contract No. 34.

For steel highway bridge over Erie canal at Waterford.

Nothing done but riveting during February. Riveting completed on the 20th. Seventy and six-tenths per cent done.

Contract No. 11.

For prism excavation, and construction from Contract No. 2 to Mohawk river below Crescent, including Locks 4, 5 and 6, highway, bridge abutments, guard-gate masonry, etc.

The steam shovels excavated about 10,600 cubic yards of material during February and the channeler faced nearly 3,000 square feet of rock surface. Percentage of contract completed to March 1, 17.8.

Contract No. 7.

For twelve steel highway bridges at various points on Contracts Nos. 2, 3, 4, 5 and 6.

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On Contract No. 4, Sylvan Beach bridge, erection of superstructure has been in progress during February. Both trusses are erected and all top chords are pinned and top and lower laterals are connected; the north portal struts and sways, also, are in place and bolted. On Contract No. 5, Mosquito Point bridge, flooring has been delivered during the month. Forty-five per cent of work completed.

Contract No. 16.

For eleven steel highway bridges, ten of which are at various points on Contracts Nos. 25 and 27, Champlain canal.

The material has been ordered but work on several of these bridges will be delayed by reason of changes of plans on Contracts Nos. 25 and 27.

Contract No. 14.

For work from Contract No. 11 to a point near Rexford Flats aqueduct, including Lock No. 7 and Dams Nos. 2 and 3; also including Locks Nos. 13, 14 and 15, Dams Nos. 9, 10 and 11, Mindenville retaining dam, etc.

During February the contractors have been shipping and erecting machinery and clearing the sites for Dams Nos. 2 and 3 and Locks Nos. 7 and 15; also testing excavators at Locks Nos. 7 and 15. Five-tenths per cent of contract completed.

Contract No. 8.

For constructing Dam No. 4 and Lock No. 8, at Scotia; Dam No. 5 and Lock No. 9, at Rotterdam; Dam No. 6 and Lock No. 10, at Crane's Village, all on the Mohawk river.

No construction work was in progress during February. Ten and two-tenths per cent of entire contract is completed.

Contract No. 17.

For constructing Dam No. 7 and Lock No. 11, at Amsterdam, and Dam No. 8 and Lock No. 12, at Tribes Hill.

After the financial failure of the original contractors, The Scofield Co., the Superintendent of Public Works proceeded with a part of the work till December 21, 1907. The contract was readvertised and bids were opened on February 18, the work being awarded to Alexander Murdock, representing the Fidelity

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& Deposit Co. During the latter part of the month this company has had men at work in repairing the machinery. Work done to March 1, 6.9 per cent.

Contract No. 18.

For excavating prism, Mindenville to Castle Creek; constructing Lock No. 16, dam at Castle Creek and incidental structures.

Operations have been greatly hindered during February by the conditions of cold and snow, but progress has been made in clearing, grubbing, excavation, embankment, concrete work and dredge-building. Nearly thirteen thousand cubic yards of material have been excavated, and about eight thousand cubic yards of embankment have been placed. Percentage of work done, 16.1.

Contract No. 1.

For dredging Hudson river channel from Northumberland to Fort Miller and from Crocker's Reef to Fort Edward; constructing Crocker's Reef dam and approaches to "Land Line," etc.

Operations have been practically at a standstill during February, on account of weather conditions. A small force has been drilling and blasting rock on the "Land Line." The contractor is also moving and repairing his machinery. Fifty-six per cent of all work done.

Contract No. 3.

For excavating prism from Fort Miller to Crocker's Reef, constructing Lock No. 6, guard-gate, bridge foundations, etc.

In January work was suspended on this contract for the winter and had not been resumed on March 1. Seventy-seven and eight-tenths per cent of the whole amount has been completed.

Contract No. 27.

For work between Dunhams Basin and Fort Edward, including Locks Nos. 7 and 8, junction lock, spillways, power plants, concrete arch bridge, etc.

At Lock No. 8, the excavation is practically completed to rock-surface, awaiting the erection of a drilling plant. During February the contractor has been engaged in driving foundation piles at the junction lock, making movable concrete forms, erecting a stone-crushing plant and delivering piles. Amount of whole contract completed, 6.9 per cent.

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Contract No. 25.

For prism excavation between 0.6 mile north of Comstock post-office and highway crossing at Dunhams Basin; constructing Lock No. 9, spillways, power plants, etc.

Work has been shut down for the winter, the contractor doing little during February, except in the way of repairing and increasing plant. Six and five-tenths per cent of work done to March 1.

Contract No. 15.

For prism excavation, and constructing Lock No. 11, Dam No. 4; Lock No. 12, Dam No. 5; spillway, culverts, highway, bridges and other structures between 0.6 mile north of Comstock post-office and Lake Champlain at Whitehall.

During February the drilling and excavating of rock has been in progress at Lock No. 12, about fifteen hundred cubic yards having been taken out. The contractor has also been engaged in building concrete forms, setting up stone-crusher, clearing right of way, blasting ice, extending tracks, building scows and generally repairing and increasing plant. Percentage of all contract work done, 11.9.

Contract No. 4.

For excavating prism from Oneida lake about four miles east; constructing bridge foundations, stream entrances, crib and pile docking, breakwater and guard-pier in Oneida lake, etc.

Work practically shut down for the winter. During February cribs in the vicinity of Sylvan Beach have been topped out. Thirty per cent of whole amount done to March 1.

Contract No. 12.

For excavating prism between Oneida lake and Mosquito Point bridge on Seneca river; constructing Lock No. 23 and other structures.

No construction work has been done on this contract; the contractors are building two dredges and installing other machinery.

Contract No. 5.

For prism excavation, construction of Owasco creek entrance, bridge foundations at Mosquito Point, Sibley's and Fox Ridge highway crossings, etc.

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No construction work has been done during February. The contractor is dismantling his hydraulic dredge preparatory to moving it to Contract No. 4. Thirty-three and a half per cent of contract completed.

Contract No. 10.

For prism excavation, constructing Locks Nos. 2 and 3, dams, bulkheads, etc., at Fulton.

No construction work was done during February; weather conditions interfered for the first five days and on the sixth a representative of the Superintendent of Public Works took control. Amount of work done to March 1, 9.4 per cent.

Contract No. 35.

For prism excavation, and constructing Locks Nos. 7 and 8, bulkheads, culverts, spillways, etc., between a point one-half mile above Utica street bridge and harbor line north of Bridge street bridge at Oswego.

On the 13th of February the contractor resumed operations after about three weeks of idleness owing to the severe weather and snow storms. Thereafter he was engaged in widening a coffer-dam, erecting concrete-mixing and stone-crushing plants, and in excavating a small amount of material in the prism between Locks Nos. 7 and 8. Percentage of work done, 0.5.

Contract No. 6.

For prism excavation, and construction of five bridge foundations between a point just south of Buffalo road and another point near South Greece and southwest of Rochester.

No excavating was done during February until the 22d. Then, repairs having been made to the bucket, the conveyor resumed work, taking out about 10,500 cubic yards of rock before the close of the month. New motors are being installed for operating the drainage pumps. Amount done to March 1, 49.2 per cent.

Contract No. 19.

For prism excavation, rebuilding bridges, constructing masonry culvert, concrete-capped pile docking, etc., between Sulphur Spring guard-lock and mouth of Ellicott creek.

The work of excavating has not been in progress during the month of February. Five and one-tenth per cent of all work done.

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Detailed Account of Plans Being Prepared.

The following is a detailed account of the plans in process of preparation at the main and residency offices. An order according to location is followed, as explained in the account of work under contract.

Contract No. 30.

For dredging Mohawk river channel and building structures from Indian Castle to near Utica, except parts included in Contract No. 31. Plans 70 per cent completed.

Contract No. 68.

For constructing Lock No. 3, at Mechanicville; making prism excavation and constructing Lock No. 4, at Stillwater; prism excavation and Lock No. 5, at Northumberland. Plans 75 per cent completed.

Contract No. 28.

For constructing concrete apron at Crocker's Reef dam. Plans completed.

Contract No. 55.

For constructing a dam, waste-gates and spillway, four locks, Black River Canal aqueduct over Mohawk river, and relocation of Black River canal at Delta. Plans 95 per cent done.

Contract No. 46.

For prism excavation, and construction of a lock, a movable dam and bridges between Fox Ridge and the south line of Wayne county,— about ten miles. Plans 60 per cent done.

Contract No. 47.

For work between the south line of Wayne county and Geneva street, Lyons, including prism excavation, a lock, a fixed dam and bridges,— about 16 miles. Plans 40 per cent completed.

Contract No. 48.

For prism excavation, and building of structures from Geneva street, Lyons, to Port Gibson,— about 8½ miles. Plans under way.

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Contract No. 49.

For excavating prism, and building structures between Port Gibson and the Wayne–Monroe county line,— about 14 miles. Plans under way.

Contract No. 63.

For work between the Wayne–Monroe county line and Kings Bend, west of Pittsford — about 12¼ miles. (The number 63 was originally assigned to work which is now included in Contract No. 62.) Surveys in progress.

Contract No. 23.

For prism excavation, constructing Locks Nos. 32 and 33 and appurtenant structures, culverts, bridge foundations, etc., between Kings Bend and the east bank of the Genesee river. Plans 40 per cent done.

Contract No. 21.

For prism excavation, and constructing bridge foundations, etc., between point just north of Scottsville road and another point just south of Buffalo road and south of Rochester, dredging Genesee river, constructing guard-lock, guard-gate and controlling dam at Genesee river crossing. Plans under way.

Contract No. 60.

For prism excavation, and construction of culverts, bridge substructures, etc., between a point 1.75 miles east of South Greece and a point 0.5 mile west of Adam's Basin bridge. Plans practically completed.

Contract No. 65.

For constructing aqueduct at Oak Orchard creek crossing and bridges at Medina. Length, 0.87 mile. (The number 65 was originally assigned to work which is now included in Contract No. 64.) Borings and plans under way.

Contract No. 67.

For construction of two locks and approaches, power plant, etc., at Lockport. Plans 25 per cent done.

The plans for contracts not enumerated in this list are practically in the same condition as reported in the February issue of the *Barge Canal Bulletin.*

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Contracts Let.

Contract No. 17, for constructing Dam No. 7 and Lock No. 11 at Amsterdam, and Dam No. 8 and Lock No. 12 at Tribes Hill, was awarded to The Scofield Co. on December 29, 1906. After the financial failure of that company the contract was canceled and bids for a new letting were opened on February 18, 1908. The contract was awarded to Alexander Murdock, representing the Fidelity & Deposit Co., of Maryland, the surety company on the Scofield Co.'s bonds. The amount of the contractor's bid is $804,516.

Contract No. 9, for prism excavation and structures between a point near Eagle Harbor and a point near Beal's bridge, was awarded to the Thomas Crimmins Construction Co., of New York, on March 11, 1908, bids having been received on the preceding day. The engineer's estimate for this work is $724,014; the contractor's bid, $755,995. The contract calls for the completion of the work by May 1, 1910. A bid was received from the Walsh Construction Co., of Davenport, Iowa, the amount being $789,654.

Contract Advertised.

Contract No. 26, for dredging Hudson river channel between Fort Edward and north end of Contract No. 1, is advertised for letting on March 26, 1908.

Contracts Approved by Canal Board.

At a meeting on March 4, 1908, the Canal Board approved the plans for the following contracts:

Contract No. 20, for dredging Mohawk river channel and for stream entrances between Rexford Flats and Mindenville.

Contract No. 45, for constructing Lock No. 24, with its approaches and power plant, a bridge substructure, and raising crest of Baldwinsville dam.

Contract No. 64, for prism excavation, construction of bridges and approaches, from a point near Beal's bridge to 100 feet east of Gasport bridge, except the aqueduct across Oak Orchard creek at Medina.

Pending certain decisions in regard to Contract No. 43, the Board has not yet approved of Contract No. 42, the section between Utica and Oriskany.

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Plans before Advisory Board.

Plans for Contract No. 31, for prism excavation, Jacksonburg to Herkimer, lock at Jacksonburg, guard-gate at Herkimer, bridges, etc., are in the hands of the Advisory Board of Consulting Engineers, awaiting their action.

Canalizing the Hudson, Troy to Waterford.

The State Engineer has prepared a memorial to the Congress of the United States, asking for Federal aid in canalizing the Hudson between Congress street, Troy, and the beginning of the Barge canal at Waterford. He will present this memorial within a short time. The commercial organizations of Albany and Troy are also taking steps to gain this same end.

Then and Now — A Contrast of Methods.

The average citizen of the State, not connected or in touch with the vast preparations for the construction of the two-thousand-ton Barge canal now in progress, involving the assembling of contractors' plants costing some millions of dollars in the aggregate, with huge machines of latest design, to take the place and do the work of the armies of *navvies* formerly required to construct similar public works of importance, naturally has but a faint idea of the rapid advance of engineering methods and appliances within the past few years. His failure to realize these conditions finds expression in fears that the great waterway cannot be finished within the time allowed or for the sum allotted for its completion.

As a matter of fact, aside from the interruptions by breakages and from natural causes, as from ice and floods, once the contractor's plant is in efficient operation, the rest is a mere matter of money and months, and the completion of the contract can be calculated with a fair degree of precision.

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No sharper way can probably be devised to enable one to realize this rapid advance in construction appliances than by a brief comparison; nor is it necessary for this purpose to go back four thousand years to the days of Cheops and the building of Egypt's pyramids. Our own Erie canal was in the first instance dug with pick and shovel, plow and scraper. We quote from the report of the Commissioners to the Assembly on January 31, 1818:

"It has been ascertained that much labor in excavation is saved, especially in dry ground, by the use of the plough and scraper; and it is found that banks constructed in this way, by being constantly travelled over by the teams with their loads, are much more solid and less liable to leakage, than those which are made after the European method with the spade and wheel-barrow.

"And even with the spade and wheel-barrow, more progress can be made in excavation, than was supposed. As an exemplification of this remark, the commissioners state with the fullest confidence, on the authority of Messrs. Pease, Mosely and Dexter, that three Irishmen in their employ, finished, including banks and towing-path, three rods of the canal, in four feet cutting, in the space of five and a half days. Thus sixteen and a half days' work accomplished the excavation of two hundred forty-nine and one-third cubic yards; which at twelve and a half cents per cubic yard, would produce to each workman the very liberal wages of one dollar and eighty-eight cents per day."

Where now is the time-honored shovel? And it may with equal pertinence be asked, Where are the Irishmen? As to the latter query, read the lists of prominent engineers and leading contractors engaged in the building of the Barge canal. The shovel, like the canal mule, has served a noble purpose. Let it rust in peace. We do not need it now.

Within the last half century by far the greatest change in methods has occurred. Less than forty years ago the Suez canal was completed, which joined the Occident to the Orient and made the continent of Africa an island. Its success, like that of every other great enterprise, at one time was imperiled by its political and professional critics. A short ten years before its completion the eminent English engineer, Robert Stephenson, pronounced "the scheme impracticable" and predicted its failure. It remained for its promoter, Count Ferdinand de Lesseps, to prove

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its glorious reality. Yet during its construction, his ally, the Viceroy of Egypt, drove the wretched *fellaheen* by tens of thousands, under its broiling sun, to scoop the sands of the desert with their naked hands into shallow baskets, to be transported upon their heads, under the savage lash of the overseer, to the spoil bank. And so familiar were they with this method, that later, as history relates, when wheel-barrows were placed before them, with considerable difficulty they were taught not to carry the wheel-barrow with its load of sand on their heads as before. At night their tired bodies rested on the adjacent bank without protection, save some, more cunning than their fellows, procured two planks and placed them A-shaped, their bases bedded in the sand. Into this "shelter," thus enclosed, they crept and slumbered peacefully. The cruelty and consequent mortality of these methods at length aroused attention. Europe rose in protest and more modern methods completed this great work.

To-day far better results are obtained, by more humane as well as scientific methods. The route of the Barge canal, in large measure following the alluvial beds of the Hudson, the Mohawk, the Oswego, the Seneca and Oneida rivers, offers a particularly favorable locality for the use of rapid methods of excavation, best handled by hydraulic suction dredging. Of this class of appliances the dredge-boat *Oneida,* built especially for this work, operating on Contract No. 4, at the eastern end of Oneida lake, and its twin, the *Ontario,* working further west along the reaches of the Seneca river and through the Montezuma marshes, are splendid types. Within the steel hull of the *Oneida,* but ninety-seven feet in length by seventeen and one-half feet beam, built to enable it to pass the locks of the Erie canal, are compactly installed pipes, centrifugal pumps, engines and machinery of a thousand horse-power, fit for a boat of four times its size, together with twin revolving cutters, which may be lowered to the face of the cut from the front. Fuel oil is used beneath the boilers. Behind, the long line of pontoons, supporting the discharge pipe, stretches away to the spoil banks, as it may be directed.

The bank requires protection, lest a portion of the enormous flood of semi-liquid material projected from the discharge pipe should find its way back into the channel. This necessitates the throwing up of an embankment or levee on either side of the canal, behind which the spoil may safely be deposited. For this special purpose a newly patented machine, named from the German city of its invention the Lubecker, is utilized. It has been

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aptly described as resembling a huge bat against the sky-line. One wing carries a series of revolving buckets, which in their passage scrape the soil from a trench some seven feet deep by twenty wide. On the other wing a series of conveyors carries the soil out and drops it in place to form the dyke or levee, behind which the unstable product of the dredge may safely lie stored to drain away and again recover its stability. The material of the prism between these marginal dykes is not as yet disturbed.

Into this laneway, thus prepared, floats the giant suction dredge. Within the pilot house above, which overlooks the cut, stands a single skilled operator, in sequent shifts,— for such a machine cannot afford to lie idle — shielded from storm by day and shrouded by darkness at night behind the hooded glare of a strong electric light directed upon the work ahead. His single hand upon the proper one of fourteen levers at his front, raises and lowers the great arms bearing the cutters and the suction pipes, directs their movements to and fro, swings the machine upon its spud pivots and controls the throbbing pumps and engines. Hour by hour the cutter-heads revolve beneath the turbid water, each shod with a dozen knives of manganese steel, tearing and loosening the soft material from its native bed, be it loam, sand, silt, marl or clay, mingling it with the water, only to be drawn by the powerful pumps into the waiting mouths of the suction pipes, up, through and out into the line of discharge pipes. Still under the resistless pressure of the pumps, the rushing stream is urged forward until finally it emerges at the distant levee over which it is thrown upon the spoil bank beyond. Ten, twelve, fifteen, seventeen thousand cubic yards of spoil deposited has been no infrequent day's record for this giant dredge and the limit of its capacity has not yet been reached. Two hundred thousand cubic yards per month will probably prove to be much below its future average. The toilsome and inhuman methods practiced in the days of the building of the Suez canal need not be repeated here. In its transference neither hand of man nor blade of shovel has touched this soil and in its accomplishment no man need step upon the shore.

Enormous though its output is, by way of contrast, yet it must not be understood that this is the largest suction dredge in existence. Under other conditions far more powerful dredges are in use. For coastal and harbor use huge sea-going vessels, both with self-contained hoppers or with attendant barges, suck up the sand from the harbor bars and shoals, steam out to sea and dispose of

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their burden, or, as in the case of the German dredge for use on the river Jade, it is delivered over the side at the rate of 6,500 cubic yards per hour, to be borne out by the swift-running current into deep water beyond the limits of the bar, or again, reversing the process, as at modern Galveston, pumping sand from the gulf to raise the grade of two and one-half square miles of the city an average height of seven feet, behind its concrete-steel protective sea-wall.

Nor must it be inferred that these conditions are applicable to the entire line of the Barge canal. Other types of excavators, each best suited to the particular work in hand will doubtless be employed. Indeed, some are already installed and in efficient operation, and others will follow as the work develops. The endless-chain, barge-loading type, once used upon the Suez canal and still a favorite in Europe, will perhaps, by reason of the confined areas and sheltered situation, be supplanted largely by the powerful American dipper, which, in charge of a skilled operator, can make a speed of two 6-yard-dipper loads per minute, and costs less to build and run.

The grapple or the clam-shell type for use in soft material, or fitted specially for picking up blasted rock, is well adapted to its purpose. An electrical grab-bucket machine is now installed near Rochester, capable of an output of three to four hundred cubic yards of earth and rock per hour.

And finally, for much of the rock and gravel cuttings in the dry, some of the divers forms of steam shovels, following the blast where necessary, will find their appropriate use.

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APRIL, 1908

Barge Canal Bulletin

Series I No. 3

DEPARTMENT OF

THE STATE ENGINEER AND SURVEYOR

OF THE

STATE OF NEW YORK

FREDERICK SKENE, State Engineer and Surveyor

ISSUED MONTHLY UNDER THE AUTHORITY OF THE STATE ENGINEER, BY THE BUREAU OF PUBLICATION AND REPORTS, DEPARTMENT OF THE STATE ENGINEER AND SURVEYOR

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Contract, No. 8.
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JAMES BURDEN, Resident Engineer.

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Erie, Nos. 6 and 7,
GUY MOULTON, Resident Engineer.

Erie, No. 9,
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Erie, Nos. 10 B and 11,
T. W. BARRALLY, Resident Engineer.

Champlain, No. 2,
E. V. R. PAYNE, Resident Engineer.

Oswego, No. 1,
THERON M. RIPLEY, Resident Engineer.

Water-Supply,
W. H. VAN WIE, Resident Engineer.

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Progress of Contract Work.

During the month of March, not much progress has been made in the way of construction work. It will be seen in the following pages that the contractors have scarcely begun their season's work, but many of them have been engaged in repairing or installing plants. Work on the preparation of plans and estimates has been steadily progressing.

The following table shows the cost of work done to April 1, 1908, on the several pieces of work under contract, together with the amounts done during March, 1908, and the whole percentage of work performed. A detailed account of what has been done on each contract will be found on later pages of this *Bulletin*.

Contract No.	CONTRACTOR.	Total Value of Work.			Percentage of work done to April 1, 1908.
		Put under contract.	Done to April 1, 1908.	Done during March, 1908.	
1	Empire Engineering Corporation	**$605,008	$338,690	0	56.0
2	The Ferguson Contracting Company	*902,145	468,110	0	51.9
3	Sundstrom & Stratton	*657,273	511,170	0	77.8
4	Empire Engineering Corporation	*725,065	218,550	$1,840	30.2
5	Empire Engineering Corporation	*375,872	125,820	0	33.5
6	Frank A. Maselli	*1,022,601	515,170	12,940	50.4
7	Groton Bridge Company	*97,537	53,850	9,980	55.2
8	Pittsburg-Eastern Company	*1,434,755	146,390	0	10.2
9	Thos. Crimmins Construction Company	*755,995	0	0	0
10	Mosier & Summers	*1,107,610	106,130	2,580	9.6
11	Fort Orange Construction Company	**1,359,475	250,630	9,550	18.8
12	Stewart-Kerbaugh-Shanley Company	3,391,716	0	0	0
14	Acme Engineering & Contracting Company	2,935,763	17,210	2,620	0.6
15	Atlantic Gulf & Pacific Company	*1,520,547	183,250	2,510	12.0
16	United Construction Company	63,473	0	0	0
17	Alexander Murdock	**836,643	57,560	0	6.9
18	O'Brien & Hoolihan Contracting Company	*861,599	154,430	15,600	17.9
19	Great Lakes Construction Company	1,000,497	51,190	0	5.1
25	Atlantic, Gulf & Pacific Company	*1,717,649	112,580	30	6.6
26	Lake Erie Dredging Company	59,795	0	0	0
27	Kinser Construction Company	*943,540	66,000	570	7.0
34	M. Fitzgerald	*22,449	17,970	2,110	80.0
35	Gilmour-Horton-Allen Company	739,261	4,120	460	0.6
	Totals	$23,136,268	$3,398,820	$60,790	

*Includes all alterations in force to date.
**Includes all alterations in force to date, except the last.

In the foregoing table the numbers which represent the percentage of work done, are based on the relation which the value of work performed bears to the total value of work under contract; or briefly, the only common unit of comparison — that of money

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value — is used. Lest this might mislead one not familiar with the progress on the several contracts, more detailed tables are given, showing what percentage of each item on each contract has been completed. It must be noted, however, that for the sake of brevity the kinds of work on which nothing has been done have been omitted.

ITEM OF WORK.	Preliminary estimate.	Total work to April 1, 1908.	Per cent of work to April 1, 1908.
CONTRACT 1.			
Clearing ..... lump sum	*1	45%	45
Grubbing ..... cu. yds.	*2,400	1,337	55.7
All excavation ..... "	*913,500	522,974	57.2
Forming embankment ..... "	*26,000	11,764	45.2
Yellow pine timber ..... ft. B. M.	*90,000	23,307	26
Round " ..... lin. ft.	*70,750	38,857	55
First class concrete ..... cu. yds.	*1,000	828	Fin's'd
Second " ..... "	*4,110	2,415	58.7
Third " ..... "	*300	331	Fin's'd
Stone filling ..... "	*6,250	3,437	55
*Not adjusted for alteration of March 25, 1908.			
CONTRACT 2.			
Clearing ..... lump sum	.....	90%	90
Grubbing ..... cu. yds.	1,200	135	11
All excavation ..... "	584,809	359,885	61
Sheeting and bracing ..... ft. B. M.	50,000	23,600	47
Forming embankment ..... cu. yds.	110,410	17,117	16
Foundation piles, 15′ and 20′ long ..... each	2,130	1,485	70
" " 25′ " ..... "	100	3	3
Second class concrete ..... cu. yds.	95,464	51,383	54
Third " ..... "	500	414	83
Iron castings, plain ..... lbs.	232,900	156,183	67
" machined ..... "	58,000	39,825	69
Steel castings ..... "	15,000	8,551	57
Structural steel ..... "	115,248	21,770	19
Coping ..... cu. yds.	7	2.3	33
Fender fastenings ..... lbs.	860	344	40
Oak miter sill ..... ft. B. M.	6,000	1,423	24
Additional bailing & drainage, Lock No. 2. lump sum	.....	27%	27
" " 3. "	.....	90%	90
Additional forms and labor ..... "	.....	53%	53
Additional labor and material ..... "	.....	50%	50
Manholes and catch basins ..... "	.....	100%	100
CONTRACT 3.			
Clearing ..... lump sum	1	100%	100
Grubbing ..... cu. yds.	8,389	6,984	83.3
Excavation, inside ..... "	831,507	730,179	88
" outside ..... "	*18,000	*18,486	102.7
Forming embankment ..... "	111,379	91,956	82.5
Lining ..... "	5,300	3,372	63.5
Puddle ..... "	900	734	82
Yellow pine timber ..... ft. B. M.	50,000	21,602	43.2
Hemlock timber ..... "	11,000	9,179	83.4
Foundation piles, 15′ long ..... each	8	8	100
" 20′ " ..... "	4	4	100
" 25′ " ..... "	4	4	100
Second class concrete ..... cu. yds.	34,373	26,239	76.5
Third " ..... "	450	378	84
Wash wall ..... "	27,458	178	0.6
Iron castings ..... lbs.	136,529	112,711	82.5
Structural steel ..... "	62,838	24,212	38.5
Steel castings ..... "	5,000	1,477	30
Wooden fencing ..... lin. ft.	4,800	2,838	59
Removing, etc., old bridge ..... lump sum	1	100%	100
Extra forms, etc	1	100%	100
Iron castings, machined ..... lbs.	†24,000	†25,152	100
Forms for recesses	1	52%	52

*Increase due to error in preliminary estimate.
†Increase due to overrun in castings.

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ITEM OF WORK.		Preliminary estimate.	Total work to April 1, 1908.	Per cent of work to April 1, 1908.
CONTRACT 4.				
Clearing	lump sum	1	90%	90
Grubbing	cu. yds.	2,800	2,421	86.5
All excavation	"	2,942,321	1,034,513	35.2
Forming embankment	"	159,905	20,532	12.8
Yellow pine	ft. B. M.	300,000	86,506	28.8
White oak	"	10,000	2,810	28.1
Round timber	lin. ft.	565,000	109,375	19.3
Square sawed hemlock	ft. B. M.	412,000	99,010	24
Foundation piles, 12′ long	each	1,908	1,966	103.5
" 20′ "	"	256	174	67
" 35′ "	"	88	56	64
Mooring piles, 30′ long	"	14	6	43
Docking piles, 30′ long	"	283	265	94
Sheet piling	ft. B. M.	378,352	365,374	97
Steel and iron fastenings	lbs.	90,000	13,892	15.4
Second class concrete	cu. yds.	10,058	1,267	12.7
Stone filling	"	48,000	7,782	16.2
Second class riprap	"	2,962	77	2.6
Maintaining traffic		.....	88.3%	88.3
First class concrete	cu. yds.	1,250	299	24
Foundation piles, 25′ long	each	132	104	79
Steel reinforcement	lbs.	139,100	22,051	15.8
Extra labor and forms		1	96%	96
Removal of revetment	cu. yds.	6,965	1,900	27.3
Overhaul on extra excavation	"	611,043	79,462	13
CONTRACT 5.*				
Clearing	lump sum	1	87%	87
All excavation	cu. yds.	2,583,662	901,601	35
Forming embankment	"	25,699	10,649	41.5
Lining	"	1,900	155	8.2
Hemlock	ft. B. M.	171,550	56,457	33
Foundation piles, 12′ long	each	725	31	4.3
" 25′ "	"	200	5	2.5
Second class concrete	cu. yds.	3,018	1,770	58.6
First class masonry coping	"	10	6.81	68.1
Stone filling	"	979	363	37.1
CONTRACT 6.				
Clearing	lump sum	1	80%	80
Grubbing	cu. yds.	4,500	3,711	82
All excavation	"	2,091,760	1,095,743	52.4
Forming embankment	"	33,340	28,899	87
Second class concrete	"	1,394	234.2	17
Third "	"	300	264.6	88.0
First class masonry coping	"	15	2	13.3
CONTRACT 7.				
Clearing	lump sum	31	2%	6.5
Setting coping	cu. yds.	29.6	8.3	28
Structural steel	lbs.	1,795,000	1,060,671	59.1
Yellow pine, prime	ft. B. M.	10,800	10,408	96.5
" merchantable	"	28,100	27,329	97
Concrete in bridge floor	cu. yds.	130	92.9	71
Metal reinforcement	lbs.	20,000	15,222	76
Railing on bridge	lin. ft.	2,055	84	4.1
Wood pavement	sq. yds.	320	158.2	49
Removal of existing structures		1	1	100
CONTRACT 8.				
Clearing	lump sum	1	66.7%	66.7
Excavation	cu. yds.	362,540	117,486	32.4
Sheeting and bracing	ft. B. M.	100,000	6,750	6.7
Embankment	cu. yds.	65,000	3,500	5.4
16′ piles	each	3,300	144	4.4
18′ "	"	4,105	226	5.5
20′ "	"	1,100	122	11.1
25′ "	"	8,927	2,694	30.2

*The work west of Fox Ridge (Sta. 5202) was abandoned by resolution of the Canal Board, dated September 29, 1907, but the quantities in this column are left as shown until the completion of the negotiations with the contractor for such modification of contract as will eliminate the work so abandoned.

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ITEM OF WORK.	Preliminary estimate.	Total work to April 1, 1908.	Per cent of work to April 1, 1908.
CONTRACT 8—(*Continued*).			
30′ piles.....each	350	186	53.1
Wooden sheet-piling.....ft. B. M.	441,360	18,000	4.1
Second class concrete.....cu. yds.	89,955	6,991	7.7
Grouted filling..... "	4,200	290	6.9
Iron castings.....lbs.	33,000	5,050	15.3
Structural steel..... "	3,550,000	649	.01
Metal reinforcement..... "	428,075	8,424	2.1
Upper lock gates.....each	6	3.4% of one gate....	0.5
Needle dams..... "	6	7% of one dam....	1.2
Valve seat supports..... "	12	2	16.6
CONTRACT 10.			
All excavation.....cu. yds.	464,700	103,100	22.2
Sheeting and bracing.....ft. B. M.	50,000	57,500	115
Second class concrete.....cu. yds.	88,800	2,180	2.5
Wash wall..... "	3,912	446	11.4
Removing buildings.....lump sum	.....	40%	40
Deduct value buildings in place..... "	.....	40%	40
CONTRACT 11.			
Clearing.....lump sum	.....	90%	90
Grubbing.....cu. yds.	*15,000	8,094	54
All excavation..... "	*800,000	268,146	33.5
Rock channeling.....sq. ft.	*96,000	16,193	17
Sheeting and bracing.....ft. B. M.	*200,000	177,185	88.6
Forming embankment:			
First class.....cu. yds.	*115,000	11,364	10
Second class..... "	*275,000	43,250	16
Lining..... "	*6,000	2,243	37.4
White oak.....ft. B. M.	*14,000	1,410	10
Foundation piles, 15′ long.....each	50	50	100
" 20′ " ..... "	300	258	Fin's'd
Concrete.....cu. yds.	*165,000	18,281	11.1
Steel castings.....lbs.	*20,000	1,052	5.
Iron " plain..... "	*380,000	91,906	24.2
" " machined..... "	*90,000	27,984	31.1
Structural steel..... "	*110,000	3,296	3
Metal reinforcement..... "	*450,000	950	0.2
*Not adjusted for the alteration dated March 25, 1908.			
CONTRACT 14.			
Clearing.....lump sum	.....	30%	30
All excavation.....cu. yds.	810,000	23,394	2.9
Clearing.....lump sum	1	86%	86
All excavation.....cu. yds.	2,907,600	569,181	19.6
Sheeting and bracing.....ft. B. M.	50,000	11,076	22.2
Forming embankment.....cu. yds.	197,530	1,736	0.9
Foundation piles, 15′ long.....each	3,500	1,153	32.9
" 20′ " ..... "	1,160	1,300	112.0
Sheet-piling.....ft. B. M.	102,500	13,825	13.5
Second class concrete.....cu. yds.	55,890	1,395	2.5
Iron castings.....lbs.	166,000	777	0.5
Metal reinforcement..... "	127,000	1,884	1.5
Needle dam, upper end of Lock No. 12.....each	1	10%	10
CONTRACT 18.			
Clearing.....lump sum	[illegible]	40%	40
Grubbing.....cu. yds.	26,000	2,248	8.7
All excavation..... "	937,700	166,724	17.8
Forming embankment..... "	500,000	84,035	16.8
Sheeting and bracing.....ft. B. M.	10,000	969	Fin's'd
Foundation piles, 13′ long.....each	120	108	90
" 20′ " ..... "	140	28	25.5
Second class concrete.....cu. yds.	30,284	8,366	27.6
Reinforced concrete..... "	500	11.9	2.4
Fourth class riprap..... "	2,500	292	11.7
Structural steel.....lbs.	24,000	6,583	27.4
Metal reinforcement.....lbs.	73,500	1,840	2.5
Iron castings, plain..... "	16,500	7,866	47.7
" machined..... "	9,000	115	1.3
Second class concrete used in place of grouted filling, cubic yards.....	950	41	4.3

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ITEM OF WORK.	Preliminary estimate.	Total work to April 1, 1908.	Per cent of work to April 1, 1908.
CONTRACT 19.			
Excavation Station 6180 to Tonawanda.....cu. yds.	2,842,000	132,176	4.6
Excavation Guard Lock to Station 6180.... "	240,000	46,779	19.5
CONTRACT 25.			
Clearing.....lump sum	1	73%	73
Grubbing.....cu. yds.	36,600	829	22.6
All excavation..... "	5,511,000	483,987	8.8
CONTRACT 27.			
Clearing.....lump sum	1	33.5	33.5
Grubbing.....cu. yds.	13,500	4,305	35
All excavation..... "	1,374,500	235,615	17.1
Sheet-piling.....ft. B. M.	484,200	75,780	15.7
Sheeting and bracing..... "	20,000	3,671	18.7
CONTRACT 34.			
Structural steel.....lbs.	352,000	345,013	98
Iron railing.....lin. ft.	314	315	Fin's'd
Moving superstructure.....	1	99%	99
CONTRACT 35.			
All excavation.....cu. yds.	206,000	3,600	1.7

Map of Barge Canal.

On pages 60 and 61 of the present number of the *Barge Canal Bulletin* there is printed a map showing the route of the Barge canal. The purpose of publishing this map is to furnish an easy means of reference for locating the several contracts, since they are not numbered in order of position. Their limits are shown by arrows. The locations of locks and dams are also given.

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Total Amount of All Kinds of Construction Work, to April 1, 1908.

Similiar kinds of work are grouped under one heading; an enumeration of the items grouped is shown in the foot-notes.

Contract Number.	Excavation.*a*	Embankment.*b*	Concrete.*c*	Dry stone work.*d*	Sawed lumber.*e*	Round timber.	Piles.	Iron and steel.*f*	Iron and steel.*g*	Miscellaneous items of work.*h*	Miscellaneous construction items.*i*	Extra and unspecified work.*j*	Extra and unspecified work.*k*
	Cu. yds.	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*	*Ft. B. M.*	*Lin. ft.*	*Number.*	*Lbs.*					
1.....	524,311	11,764	3,574	3,437	23,307	38,857	0	0	0	$288	0	0	0
2.....	360,020	17,117	51,797	0	25,023	0	1,488	226,329	$1,290	14,608	$3,094	0	$1,316
3.....	755,649	92,690	26,617	3,550	30,781	0	16	163,552	0	6,149	668	$3,713	36,044
4.....	1,036,934	20,532	1,566	7,859	553,700	109,375	2,571	35,943	0	11,848	0	0	1,257
5.....	901,601	10,649	1,770	518	56,457	0	36	0	0	2,862	153	0	0
6.....	1,099,454	28,899	498	0	0	0	0	0	0	560	46	0	0
7.....	0	0	93	2	37,737	0	0	1,075,893	0	0	838	0	0
8.....	117,486	3,500	7,281	0	24,750	0	3,372	14,123	462	200	0	0	0
10.....	103,100	0	2,180	446	57,500	0	0	0	0	0	1,012	0	0
11.....	276,240	54,614	18,282	2,243	178,595	0	308	125,189	0	1,080	2,267	0	0
14.....	23,394	0	0	0	0	0	0	0	0	30	0	0	0
15.....	569,181	1,736	1,395	0	24,901	0	2,453	2,661	240	258	0	0	0
17.....	40,964	1,615	1,322	2,321	4,348	0	373	11,811	0	200	573	0	0
18.....	168,972	84,035	8,419	292	969	0	136	16,404	0	200	0	8,410	0
19.....	178,955	0	0	0	0	0	0	0	0	0	0	0	0
25.....	484,816	0	0	0	0	0	0	0	0	1,022	0	0	0
27.....	239,920	0	0	0	79,451	0	0	0	0	276	0	0	0
34.....	0	0	0	0	0	0	0	345,013	0	0	2,449	0	0
35.....	3,600	0	0	0	0	0	0	0	0	0	0	0	0
Totals....	6,884,597	327,151	124,794	20,668	1,097,519	148,232	10,753	2,016,918	$1,992	$39,581	$11,100	$12,123	$38,617

a Includes earth and rock excavation and grubbing. *b* Includes embankment and puddle. *c* Includes concrete (all classes) and grouted filling. *d* Includes ballast, dry retaining wall, lining, riprap and stone filling in cribs. *e* Includes sawed lumber (all kinds), wooden sheet-piling and sheeting and bracing. *f* Includes chains, iron castings (plain or machined), iron pipe and specials, metal reinforcement, steel and iron fastenings, steel castings, structural steel and wrought iron. *g* Includes items paid for by the piece — fender fastenings, gate-hoists, lock-gates, needle-dams, valves, valve-seats and valve-supports. *h* Includes bailing and draining, clearing, extra labor on forms and finishing concrete, maintaining traffic, overhaul and removing revetment. *i* Includes channeling, cut stone work, iron railings, paving (all kinds), removing existing structures, repairs to local sewers, etc., sidewalks and curbs, steel sheet-piling, trenching and backfilling, vitrified pipe and wooden fencing. *j* At contract prices. *k* At cost, plus a fixed percentage.

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Comparisons between Amounts of Contracts and Engineer's Estimates.

The following table will doubtless be of considerable interest, since it gives an enumeration of the Barge canal contracts let thus far, showing the estimated cost of the several pieces of work — first, according to the engineer's estimate of 1903, second, by the engineer's estimate of 1905–8, and third, as computed on contract prices. The 1903 estimate is made up of the quantities obtained by the 1900 survey, figured at the revised prices of 1903 (except for the Champlain canal, the quantities for that canal having been increased in the 1903 estimate, so as to give a depth of twelve feet in place of nine). The 1903 estimates were made before the passage of the act authorizing construction, and their aggregate formed the basis for the $101,000,000 appropriation. The 1905–8 estimates are computed on the plans as finished for letting contracts. (The amounts here given do not include the percentage added for contingencies.) The amount of contract is calculated on the quantities that appear in the engineer's estimate of 1905–8, but computed at the prices bid by the contractor. In the table, also, this amount of contract is compared with the two engineers' estimates, showing the probable gain or loss to the State over the previously estimated cost.

An analysis of the table shows that thirteen of the 1905–8 estimates are less than the corresponding estimates of 1903, while ten are greater. The total difference on these twenty-three contracts in favor of the 1905–8 estimates is $930,016, due, in general, to improvements in location, grade, etc. Perhaps it is needless to say that this economy has not been effected at the expense of quality or good design.

It will be seen also that only five of the twenty-three contracts have been let for prices in excess of the engineer's estimate, as computed on the letting plans. Again, only five contract amounts have been greater than the 1903 estimates — the basis for the appropriation. In comparing these amounts a probable saving of 7.1 per cent is indicated. It is to be observed that the lettings marked by a spirited competition among numerous bidders show a considerable saving for the State.

A few words briefly explaining some of the differences in estimated cost may be of interest. Contracts Nos. 2 and 11 show a probable saving of $702,799 over the 1903 estimate, due in a large part to a change in location from a position near the Mohawk river bank at the Cohoes falls to a valley about a mile farther

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Contract No.	Date of letting.	Number of bidders.	1903 estimate.	Engineer's estimate of 1905–8.	Amount of contract.	Amount of Contract Compared With—							
						1903 estimate.				Engineer's estimate of 1905–8.			
						Saving.		Loss.		Saving.		Loss.	
						Amount.	Percentage.	Amount.	Percentage.	Amount.	Percentage.	Amount.	Percentage.
1	April 18, 1905	2	$632,109	$619,846	$605,008	$27,101	4	0	0	$14,838	2	0	0
2	April 3, 1905	15	1,059,906	1,022,640	852,330	207,576	20	0	0	170,310	17	0	0
3	April 4, 1905	9	702,580	760,576	670,497	32,083	4	0	0	90,079	12	0	0
4	April 18, 1905	4	792,200	812,560	726,815	65,385	8	0	0	85,745	11	0	0
5	April 18, 1905	5	404,987	421,252	381,988	22,999	6	0	0	39,264	9	0	0
6	May 3, 1905	15	1,424,101	1,381,662	1,005,982	418,119	29	0	0	375,680	27	0	0
7	Aug. 10, 1906	1	100,181	102,123	97,635	2,546	2	0	0	4,488	5	0	0
8	May 22, 1906	4	1,255,169	1,518,382	1,433,817	0	0	$178,648	14	84,565	6	0	0
9	Mar. 11, 1908	3	896,233	724,014	755,995	140,238	16	0	0	0	0	$31,981	4
10	June 7, 1906	4	1,300,000	1,149,988	1,126,718	173,282	13	0	0	23,270	2	0	0
11	May 21, 1906	8	1,854,698	1,671,385	1,359,475	495,223	27	0	0	311,910	17	0	0
12	Sept. 23, 1907	1	2,832,772	3,082,560	3,391,716	0	0	558,944	20	0	0	309,156	10
14	Sept. 10, 1907	3	2,946,617	2,875,570	2,935,763	10,854	0	0	0	0	0	60,193	2
15	Aug. 9, 1906	2	1,753,446	1,380,760	1,509,060	244,386	14	0	0	0	0	128,300	10
16	Dec. 20, 1906	8	80,234	70,719	63,473	16,761	21	0	0	7,246	10	0	0
17	Dec. 29, 1906	2	972,623	883,926	835,725	136,898	14	0	0	48,201	5	0	0
18	Dec. 28, 1906	4	1,105,899	785,980	859,460	246,439	22	0	0	0	0	73,480	10
19	Nov. 26, 1906	3	604,974	1,038,245	1,000,497	0	0	395,523	66	37,748	3	0	0
25	Nov. 19, 1906	3	1,814,136	1,849,831	1,754,236	59,900	3	0	0	95,595	5	0	0
26	April 6, 1908	2	56,000	60,225	59,795	0	0	3,795	7	430	1	0	0
27	Nov. 23, 1906	5	1,632,586	998,920	972,210	660,376	41	0	0	26,710	3	0	0
34	Aug. 8, 1906	4	45,518	22,604	20,612	24,906	55	0	0	1,992	9	0	0
35	Sept. 16, 1907	2	649,575	752,760	739,261	0	0	89,686	14	13,499	2	0	0
	Total.....	.....	$24,916,544	$23,986,528	$23,158,068	$2,985,072	....	$1,226,596	....	$1,431,570	....	$603,110	.....
	Total saving.	.....	.....	.....	.....	$1,758,476	7.1	.....	....	$828,460	3.5	.....	.....

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north, known as Cemetery creek. Viewed from an engineering standpoint, the advantages to be gained by this change far outweigh the item of cost. The change of alignment between Fort Edward and Whitehall (affecting Contracts Nos. 26, 27, 25 and 15) indicates that the gain will be $960,867, which was brought about by adopting a location in the bottom of the valley and in the creek beds, in place of the original higher position. (In making comparison, Contracts 26 and 27 should be considered together, since on the divergent locations an arbitrary line of separation had to be assumed.) A raising of the grade west of Rochester — three feet at the Genesee river and five and a third feet at Lockport — has largely contributed toward a probable saving of $558,357 on Contracts Nos. 6 and 9. The difference on No. 6 is especially large, since the originally-estimated rock excavation formed about two-thirds of the whole amount. On Contract No. 12 the numerous additional borings taken in making contract plans showed a large increase in the amount of the harder kinds of excavation. On Contract No. 19 further investigations showed the wisdom of lowering the level about six feet. At Oswego a modification in the dams was necessitated by the existing water powers, which are highly developed and cannot be disturbed without creating a claim against the State for damages. However, a considerable saving in rock excavation on the adjacent contract will result from this change.

Detailed Account of Contract Work for March.

An account of what was accomplished during March, 1908, on each piece of work under contract will be found in the following list, under its respective contract number. The order followed is one of location, and for easier reference has been changed from the list which appeared in the last number of the *Barge Canal Bulletin*. Beginning at Waterford the pieces of work on the Erie canal are given in their order toward the west to Buffalo; and the contracts on the Champlain and Oswego canals, in order from south to north, follow.

Erie Canal.

Contract No. 2.

For prism excavation and construction from Mohawk river at Waterford west, including Locks 2 and 3, to a point about one-fourth mile west of the latter.

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Construction work opened on 30th ultimo, excavating at north approach to Fourth street bridge and north core wall of Lock No. 3. Fifty-one and nine-tenths per cent completed.

Contract No. 34.

For steel highway bridge over Erie canal at Waterford.

Bridge has been moved 16 feet 3 inches to its new position, railing set, and concrete flooring forms begun. Eighty per cent completed.

Contract No. 11.

For prism excavation, and construction from Contract No. 2 to Mohawk river below Crescent, including Locks 4, 5 and 6, highway, bridge abutments, guard-gate masonry, etc.

The steam shovels removed 17,470 cubic yards of material and 4,560 square feet were channeled on the south side of the prism during the month. The Vulcan shovel was laid up for repairs on and after the twenty-third. Eighteen and eight-tenths per cent completed.

Contract No. 7.

For twelve steel highway bridges at various points on Contracts Nos. 2, 3, 4, 5 and 6.

The Groton Bridge Co. has all the steel of the Sylvan Beach bridge in place, 229,230 pounds, riveted and the remainder is being bolted. Wooden floor-stringers are being placed and one coat of paint has been given a portion of the bridge.

The false work of the Mosquito Point bridge has been erected, floor system and lower chords placed and bolted, and erection of both trusses started, but no riveting yet. The steel in place under this contract has been increased by 53 tons during the month, to which may be added 20 per cent, because no riveting has been done.

On the Champlain canal there has been no change in the work of this contract during the month. Fifty-five and two-tenths per cent completed.

Contract No. 16.

For eleven steel highway bridges, ten of which are at various points on Contracts Nos. 25 and 27, Champlain canal, and the remaining on Contract No. 11, Erie canal. In order to facilitate the progress of prism excavation on contracts Nos. 25 and 27, the bridges on these contracts will not be built until 1909.

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Contract No. 14.

For work from Contract No. 11 to a point near Rexford Flats aqueduct, including Lock No. 7 and Dams Nos. 2 and 3; also including Locks Nos. 13, 14 and 15, Dams Nos. 9, 10 and 11, Mindenville retaining dam, etc.

At Crescent the contractors have been clearing the site of Dam No. 2 and hauling supplies. At Vischer's Ferry (Dam No. 3 and Lock No. 7) additional plant has beeen installed and a traveling excavator has been at work at the foot of the lock. At Fort Plain (Dam No. 11 and Lock No. 15) additions have also been made to plant and buildings. The Page bucket traveling excavator has been working at the upper lock approach, removing about 3,000 cubic yards. Six-tenths per cent completed.

Contract No. 8.

For constructing Dam No. 4 and Lock No. 8, at Scotia; Dam No. 5 and Lock No. 9, at Rotterdam; Dam No. 6 and Lock No. 10, at Crane's Village, all on the Mohawk river.

Contract work for the season has not yet opened, but preparations are being made for resumption. Ten and two-tenths per cent completed.

Contract No. 17.

For constructing Dam No. 7 and Lock No. 11, at Amsterdam, and Dam No. 8 and Lock No. 12, at Tribes Hill.

A small force has been engaged during the month, both at Amsterdam and Fort Hunter, in repairing machinery and hauling sand and piles for upper guide-wall. Six and nine-tenths per cent completed.

Contract No. 18.

For excavating prism, Mindenville to Castle Creek; constructing Lock No. 16, dam at Castle Creeek and incidental structures.

Excavation, both steam shovel and otherwise, has been going on at various points, including rock at foundation of south wall of lock, to the amount of 17,873 cubic yards. A drainage culvert has been built behind the south lock wall. Material excavated has been used for embankment to the extent of 13,545 cubic yards, the rejected balance going to spoil bank. Six hundred and thirty-six cubic yards of concrete have been placed in lock wall. The new dredge at Mindenville is progressing rapidly. The steam shovel has been worked two shifts of ten hours each in order to have work ready for opening of canal. Seventeen and nine-tenths per cent completed.

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Contract No. 4.

For excavating prism from Oneida lake about four miles east; constructing bridge foundations, stream entrances, crib and pile docking, breakwater and guard-pier in Oneida lake, etc.

The Lubecker started on the thirtieth in advance of the big dredge, constructing drainage ditch and marginal levee. Thirty and two-tenths per cent completed.

Contract No. 12.

For excavating prism between Oneida lake and Mosquito Point bridge on Seneca river; constructing Lock No. 23 and other structures.

Contract work not yet started; work on dredge hulls progresses. A seventy-ton, two-yard dipper, Bucyrus steam shovel has arrived at Brewerton and is now being moved to the Anthony cut, as well as fifty-two four-yard dump cars and four small locomotives.

Contract No. 5.

For prism excavation, construction of Owasco creek entrance, bridge foundations at Mosquito Point, Sibley's and Fox Ridge highway crossings, etc.

No contract work done during the month. The big dredge has been dismantled and taken as far as Baldwinsville on its way to Sylvan Beach.

Under the supplementary agreement of September 25th, 87,486 cubic yards have been excavated, of which 2,985 yards are from Mosquito Point bridge foundation and 683 yards from Howland Island bridge foundation. Thirty-three and five-tenths per cent completed.

Contract No. 6.

For prism excavation, and construction of five bridge foundations between a point just south of Buffalo road and another point near South Greece and southwest of Rochester.

During the month Lyell road crossing has been raised about 18 inches with gravel and broken stone; another 6-inch centrifugal pump has been installed to aid the 10-inch pump, and both are working satisfactorily; the conveyor has been working, with an output of 27,883 cubic yards of rock, until 24th ultimo, when fire destroyed the trolley car of the conveyor. Repairs have been made and work will be resumed soon. Fifty and four-tenths per cent completed.

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Contract No. 9.

For prism excavation and structures between a point near Eagle Harbor and a point near Beal's bridge.

Awarded to the Thomas Crimmins Construction Co., of New York, on March 11, 1908, bids having been received on the preceding day. No work performed on contract yet.

Contract No. 19.

For prism excavation, rebuilding bridges, constructing masonry culvert, concrete-capped pile docking, etc., between Sulphur Spring guard-lock and mouth of Ellicott creek.

Work on this contract not yet resumed for the season. Five and one-tenth per cent completed.

CHAMPLAIN CANAL.

Contract No. 1.

For dredging Hudson river channel from Northumberland to Fort Miller and from Crocker's Reef to Fort Edward; constructing Crocker's Reef dam and approaches to "Land Line," etc.

Repairs to dredge Pontiac completed and dredge at work in prism opposite Belle Island. The spoil which is hard-pan is placed back of the island. Two steam tugs and two dump scows are in commission. Repairs continue on dredge Peconic which is to go to Northumberland when ready. High water has prevented progress on the breakwater pier. The rock-breaker is in working position, about one-fourth mile north of Billings Island. Fifty-six per cent completed.

Contract No. 3.

For excavating prism from Fort Miller to Crocker's Reef, constructing Lock No. 6, guard-gate, bridge foundations, etc.

General repair work began on 2d, and continued throughout March, rebuilding the two large steam shovels and placing derricks in position for future use. Seventy-seven and eight-tenths per cent completed.

Contract No. 26.

For dredging Hudson river channel between Fort Edward and north end of Contract No. 1, was let on March 26, 1908, at the contract price of $59,795, to the Lake Erie Dredging Co., of Buffalo.

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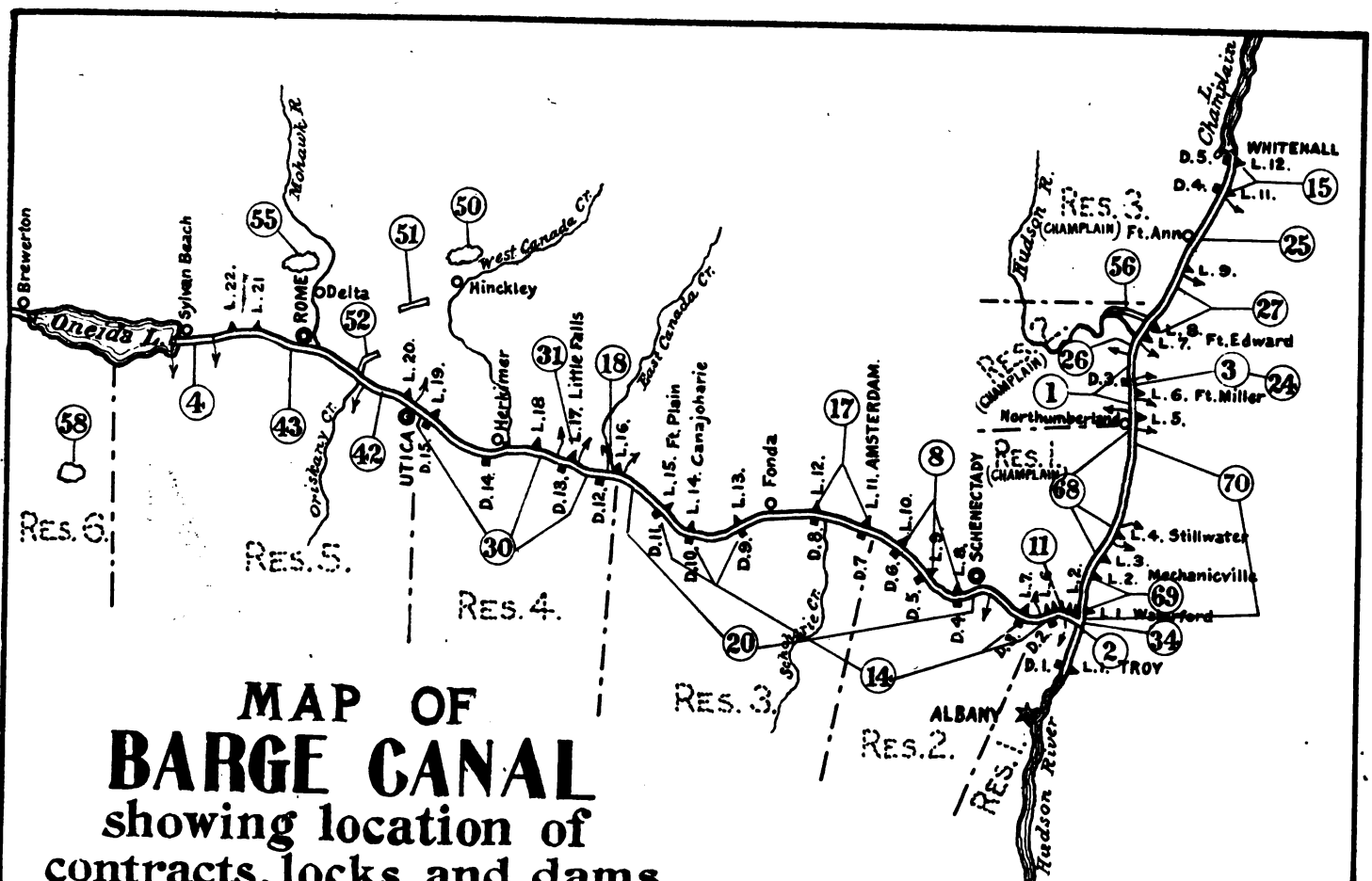

MAP OF BARGE CANAL

showing location of contracts, locks and dams.

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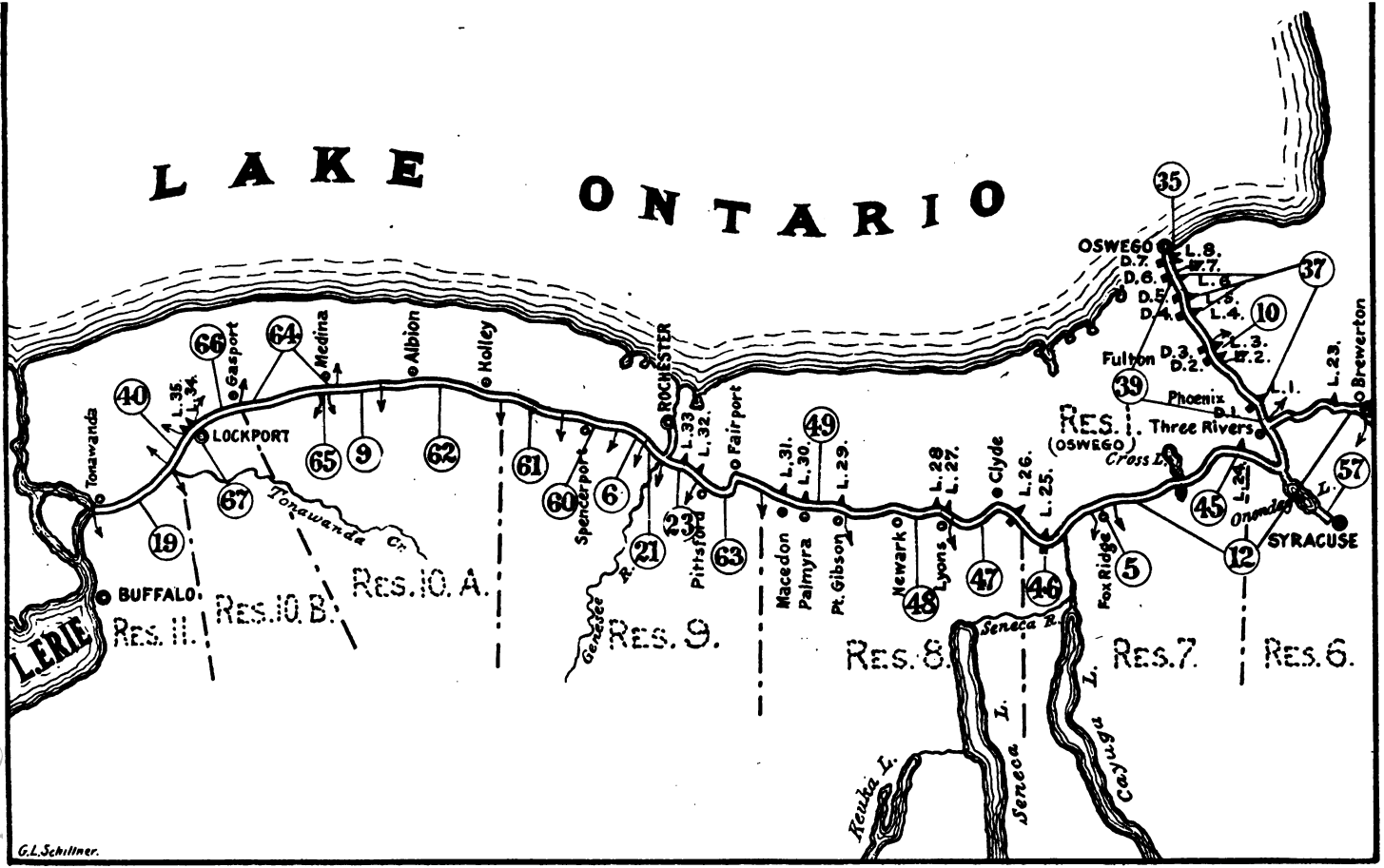
LAKE ONTARIO
L. ERIE
BUFFALO
Tonawanda
LOCKPORT
Gasport
Medina
Albion
Holley
ROCHESTER
Fairport
Spencerport
Genesee R.
Pittsford
Macedon
Palmyra
Pt. Gibson
Newark
Lyons
Clyde
Fox Ridge
OSWEGO
Fulton
Phoenix
Three Rivers
Cross L.
Brewerton
Onondaga L.
SYRACUSE
Tonawanda Cr.
Seneca R.
Reuka L.
Seneca L.
Cayuga L.
RES. 11.
RES. 10 B.
RES. 10 A.
RES. 9.
RES. 8.
RES. 7.
RES. 6.
RES. (OSWEGO)
G.L. Schillner.

Contract No. 27.

For work between Dunhams Basin and Fort Edward, including Locks Nos. 7 and 8, junction lock, spillways, power plants, concrete arch bridge, etc.

At Junction lock round and sheet piling completed, including lock proper and north splay walls. A portable mixer has been installed and sectional forms for almost entire work of lock constructed in readiness to push concrete work. At Lock No. 8 steel boiler has been installed and rock drilling will soon begin. Seven per cent completed.

Contract No. 25.

For prism excavation between 0.6 mile north of Comstock post-office and highway crossing at Dunhams Basin; constructing Lock No. 9, spillways, power plants, etc.

Contract work has not been opened, but considerable has been done in the way of repairing dredge and machinery during the month. Six and six-tenths per cent completed.

Contract No. 15.

For prism excavation, and constructing Lock No. 11, Dam No. 4; Lock No. 12 ,Dam No. 5; spillway, culverts, highway, bridges and other structures between 0.6 mile north of Comstock post-office and Lake Champlain at Whitehall.

On Lock No. 12, at Whitehall, rock drilling and excavation has proceeded in night and day shifts of ten hours each, 1,711 cubic yards having been excavated. Water in cut impeded excavation for a week. Pumps in continuous operation. About 240 cubic yards of second-class concrete laid on upper and east wall of Lock No. 12. Stone crusher began work on the fifteenth. The contractor has also been building forms, stopping leaks in coffer-dam, placing new boiler, clearing 76 acres of right of way, building and repairing scows and dredge and hauling material and supplies. Twelve per cent completed.

OSWEGO CANAL.

Contract No. 10.

For prism excavation, constructing Locks Nos. 2 and 3, dams, bulkheads, etc., at Fulton.

Some excavation was done and coffer-dam built along south end of tail race site, but not yet unwatered. Some buildings have been

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removed and new plant installed, including two guy derricks along tail race and batch concrete mixer. Nine and six-tenths per cent complete.

Contract No. 35.

For prism excavation, and constructing Locks Nos. 7 and 8, bulkheads, culverts, spillways, etc., between a point one-half mile above Utica street bridge and harbor line north of Bridge street bridge at Oswego.

North coffer-dam about completed. At Utica street about ready for rock excavation necessary before building concrete wall at bridge. Crushing and mixing plant in operation intermittently. Pulverizers for making sand from stone installed but not yet tried out. Derrick erected ready for false work. A coffer-dam will be built along east side of Lock No. 8 to permit construction to continue during navigation. High water has delayed progress somewhat. Six-tenths per cent completed.

Detailed Account of Plans Being Prepared.

The following is a detailed account of the plans in process of preparation at the main and residency offices. An order according to location is followed, as explained in the account of work under contract.

Erie Canal.

Contract No. 32.

For needle-dams on Contracts Nos. 2, 11 and 27. Plans under way.

Contract No. 30.

For dredging Mohawk river channel from Indian Castle to near Utica, except part included in Contract No. 31, constructing lock at Jacksonburg, dam and guard-gates at Herkimer, lock at Sterling creek, dam at Utica, bridges, stream entrances, etc. Contract No. 30 includes Contracts Nos. 30 and 31, as reported in the *Barge Canal Bulletin* for February. Plans 75 per cent completed.

Contract No. 31.

For prism excavation at Little Falls, constructing Lock No. 17 and Rocky Rift dam. Plans completed. Contract No. 29, as reported in the February issue of the *Barge Canal Bulletin,* has been given the number 31.

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Contract No. 42.

For prism excavation, and construction of Lock No. 20, stream entrances, spillway, bridge and other structures, between Utica and Oriskany. Plans now before the Canal Board, pending certain decisions in regard to Contract No. 43.

Contract No. 43.

For work between Oriskany and Contract No. 4. Completion of plans delayed by reason of certain decisions as to location.

Contract No. 22.

Bridges on Contract No. 12. Plans under way.

Contract No. 57.

Syracuse Harbor. Preliminary studies made.

Contract No. 46.

For prism excavation, and construction of a lock, a movable dam and bridges between Fox Ridge and the south line of Wayne county. Plans 75 per cent done.

Contract No. 47.

For work between the south line of Wayne county and Geneva street, Lyons, including prism excavation, a lock, a fixed dam and bridges. Plans 50 per cent completed.

Contract No. 48.

For prism excavation, and building of structures from Geneva street, Lyons, to Port Gibson. Plans under way.

Contract No. 49.

For excavating prism, and building structures between Port Gibson and the Wayne–Monroe county line. Preliminary surveys made.

Contract No. 63.

For work between the Wayne–Monroe county line and Kings Bend, west of Pittsford. Surveys in progress.

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Contract No. 23.

For prism excavation, constructing Locks Nos. 32 and 33 and appurtenant structures, culverts, bridge foundations, etc., between Kings Bend and the east bank of the Genesee river. Plans 55 per cent done.

Contract No. 21.

For prism excavation, and constructing bridge foundations, etc., between point just north of Scottsville road and another point just south of Buffalo road and south of Rochester, dredging Genesee river, constructing guard-lock, guard-gate and controlling dam at Genesee river crossing. Plans under way.

Contract No. 60.

For prism excavation, and construction of culverts, bridge substructures, etc., between a point 1.75 miles east of South Greece and a point 0.5 mile west of Adam's Basin bridge. Plans completed and approved by the Advisory Board.

Contract No. 61.

For prism excavation, and construction of culverts, bridge substructures, etc., between a point 0.5 mile west of Adam's Basin bridge and Monroe–Orleans Co. line. Plans well under way.

Contract No. 62.

For prism excavation, and construction of culverts, bridge substructures, etc., between Orleans–Monroe county line and a point near Eagle Harbor bridge. Plans under way.

Contract No. 65.

For constructing aqueduct at Oak Orchard creek crossing and bridges at Medina. Borings and plans under way.

Contract No. 66.

For prism excavation, constructing substructures and approaches for bridges, culverts, etc., from 100 feet east of Gasport bridge to foot of locks at Lockport. Plans 90 per cent completed.

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Contract No. 67.

For construction of Lock No. 34 and approaches, power plant, etc., at Lockport. Plans 25 per cent done, but work on them suspended pending certain decisions.

Contract No. 40.

For prism excavation, constructing substructures and approaches for bridges, etc., from head of locks at Lockport to Sulphur Spring guard-lock. Plans under way.

CHAMPLAIN CANAL.

Contract No. 69.

For constructing Lock No. 1 and Dam No. 1, above Waterford; and Lock No. 2 below Mechanicville. Surveys, borings and preliminary drawings completed.

Contract No. 68.

For constructing Lock No. 3, at Mechanicville; making prism excavation and constructing Lock No. 4, at Stillwater; prism excavation and Lock No. 5, at Northumberland. Plans 80 per cent completed.

Contract No. 70.

For dredging in the Hudson river from Waterford to Northumberland, approximate length, 24.7 miles. Plans 50 per cent done, but work on them suspended in order to expedite progress on Contracts 68 and 69.

Contract No. 24.

For constructing guard-gate at Crocker's Reef. Plans completed as far as possible, pending certain decisions of the Canal Board.

Contract No. 56.

Glens Falls Feeder. Plans 25 per cent done.

OSWEGO CANAL.

Contract No. 39.

For dredging channel in Oswego river, constructing stream entrances, excavating through Hinmansville cut-off, etc., between

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Phœnix and Oswego, except portions covered by Contracts Nos. 10 and 37. Plans 80 per cent done, but suspended pending decisions on Contract 37.

Contract No. 37.

For prism excavation, and constructing Locks Nos. 1, 4 and 5, and Dam No. 4, bulkhead and head-gates, guard-gates and dike, etc., near Minetto, movable crest on Dam No. 1, at Phœnix, and removing portion of existing dam at Battle Island. Work on plans suspended, pending certain decisions.

WATER-SUPPLY.

Contract No. 50.

For constructing dam, waste-gates and spillway across West Canada creek at Hinckley. Plans under way.

Contract No. 51.

For constructing a diverting dam and feeder to Nine Mile creek watershed. Plans under way.

Contract No. 52.

For constructing a dam on Nine Mile creek, Oneida county. Plans under way.

Contract No. 55.

For constructing a dam, waste-gates and spillway, four locks, Black river canal aqueduct over Mohawk river, and relocation of Black river canal at Delta. Plans completed.

Contract No. 58.

For constructing a dam, waste-gates and spillway across Limestone creek, at High Bridge, Onondaga county. Plans under way.

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Recapitulation — Progress on Plans.

Contract No.	DESCRIPTION.	Canal.	Progress.
20	Rexford Flats to Mindenville	Erie	Bids to be opened April 21, 1908.
21	Genesee river, west 2.56 miles	Erie	Plans under way.
22	Bridges on Contract 12	Erie	Plans under way.
23	Kings Bend to Genesee river	Erie	Plans 55 per cent completed.
24	Guard-gate at Crocker's Reef	Champlain	Plans before Canal Board.
30	Indian Castle creek to Utica	Erie	Plans 75 per cent completed.
31	Prism at Little Falls, lock and dam	Erie	Plans completed.
32	Needle-dams on Contracts 2, 11 and 27	Erie and Champlain	Plans under way.
37	Three Rivers to Oswego—structures, except on 10 and 35	Oswego	Plans suspended pending decision.
39	Three River Point to Oswego—dredging	Oswego	Plans suspended pending decision.
40	Lockport to Sulphur Spring	Erie	Plans under way.
42	Utica to Oriskany	Erie	Plans before Canal Board.
43	Oriskany to Contract 4	Erie	Plans awaiting decision as to location.
45	Baldwinsville lock and bridge and Caughdenoy dam	Erie	Bids to be opened April 21, 1908.
46	Fox Ridge to Wayne Co. line	Erie	Plans 75 per cent completed.
47	Wayne Co. line to Lyons	Erie	Plans 50 per cent completed.
48	Lyons to Port Gibson	Erie	Plans under way.
49	Port Gibson to Wayne-Monroe line	Erie	Preliminary surveys made.
50	Hinckley reservoir—water-supply	Erie	Plans under way.
51	Nine Mile creek diversion, dam and feeder	Erie	Plans under way.
52	Nine Mile creek dam and reservoir	Erie	Plans under way.
55	Delta, dam and reservoir—water-supply	Erie	Plans completed.
56	Glens Falls feeder	Champlain	Plans 25 per cent completed.
57	Syracuse harbor	Erie	Preliminary studies made.
58	Limestone creek reservoir, High Bridge	Erie	Plans under way.
60	South Greece to Adam's Basin	Erie	Plans approved by Advisory, Board.
61	Adam's Basin to Monroe-Orleans line	Erie	Plans well under way.
62	Monroe-Orleans line to Eagle Harbor bridge	Erie	Plans under way.
63	Wayne-Monroe line to Kings Bend	Erie	Surveys in progress.
64	West from Contract No. 9 to Gasport	Erie	Bids to be opened April 21 1908.
65	Aqueduct and bridges at Medina	Erie	Borings and plans under way.
66	Gasport to foot of Lockport locks	Erie	Plans 90 per cent completed.
67	Lockport locks	Erie	Plans suspended pending decisions.
68	Prisms and locks at Stillwater, Mechanicville and Northumberland	Champlain	Plans 80 per cent completed.
69	Lock and dam above Waterford and lock below Mechanicville	Champlain	Surveys, borings and preliminary drawings completed.
70	Dredging, Waterford to Northumberland	Champlain	Plans suspended to expedite 68 and 69.

Plans before Advisory Board.

The plans for Contract No. 60, South Greece to Adam's Basin, were approved by the Advisory Board at their meeting on the 3d inst.

Plans before Canal Board.

Between the dates of the last issue of the *Barge Canal Bulletin* and the present one, no further announcements of contracts finally approved by the Board have been made.

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Contracts Advertised.

On April 21, 1908, bids will be opened for the following contracts:

Contract No. 20.— For dredging a channel in the Mohawk river and performing work incidental thereto between Rexford Flats and Mindenville. Length, 53.7 miles. Estimates, $3,480,449.

Contract No. 45.— For the construction of a dam in the Oneida river at Caughdenoy and of Lock No. 24 and appertaining structures at Baldwinsville. Length, 0.55 mile. Estimates, $425,124.

Contract No. 64.— For the improvement of the Erie canal from west end of Contract No. 9, to 100 feet east of Gasport bridge, excepting the Oak Orchard creek crossing. Length, 10.988 miles. Estimates, $1,306,080.

Contract Let.

Contract No. 26, for dredging Hudson river channel between the north end of Contract No. 1 and Fort Edward, upon which bids were opened on March 26, was awarded to the Lake Erie Dredging Co. of Buffalo, N. Y., the amount of their bid being $59,795. The Empire Engineering Corporation bid $66,245. Engineer's estimate, $60,225. The following shows the itemized bids:

ITEM.	Engineer's estimate.	L. E. Dredging Co.	Emp. Eng. Corp.
Clearing	$25.00	$25.00	$25.00
Excavation—172,000 cubic yards	.35	.34½	.38½

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Movable Dams on the Lower Mohawk.

The preliminary survey for the Barge canal was made in the year 1900. Between the first of May of that year and the twelfth of the following February, all of the surveys, borings, maps, plans, computations and estimates had been completed and a voluminous report prepared and printed for transmission to the Legislature. Engineers competent to judge have called this one of the best preliminary investigations ever made on a project at all comparable in size, but in this relatively short time the studies were necessarily not exhaustive enough to insure in all cases the cheapest route or plans that might not be somewhat bettered. Consequently many minor changes of location and design have been, or are being incorporated in the plans before they are submitted for letting. Possibly as interesting as any of these changes and one that may prove the most far-reaching in its results is the substitution of movable for fixed dams in the lower Mohawk river. A comparison of these two types of structure will, perhaps, best illustrate the necessity for careful and thorough study in making proper designs for such an important undertaking and will show the benefits accruing to the State from these extended investigations.

The original plans required timber dams with rock filling, which were of the fixed type — the style of dam that has been in use for centuries, which has a crest that cannot be raised or lowered and holds back the water to a minimum level at all times. During the normal stages of a stream such a dam serves its intended purpose in retaining the water at the proper elevation for navigation; and for impounding a large body of water in a reservoir, a fixed dam is also a suitable structure, but in a river subject to floods it forms an obstruction to the rapid discharge of the surplus waters, and therefore becomes a menace to the neighboring property. The various forms of movable dams, on the other hand, are so constructed that they may be removed from the bed of the stream and thus present little or no hindrance to a flood. The movable dam first appeared about seventy-five years ago. There have been many forms devised, but in general the purpose has been either to construct a dam in sections, which in the form of gates, wickets or smaller "needles," as they have been termed, may be severally removed or raised above the water-surface, or to build a crest that may by some means be lowered into a recess below the bed of the stream.

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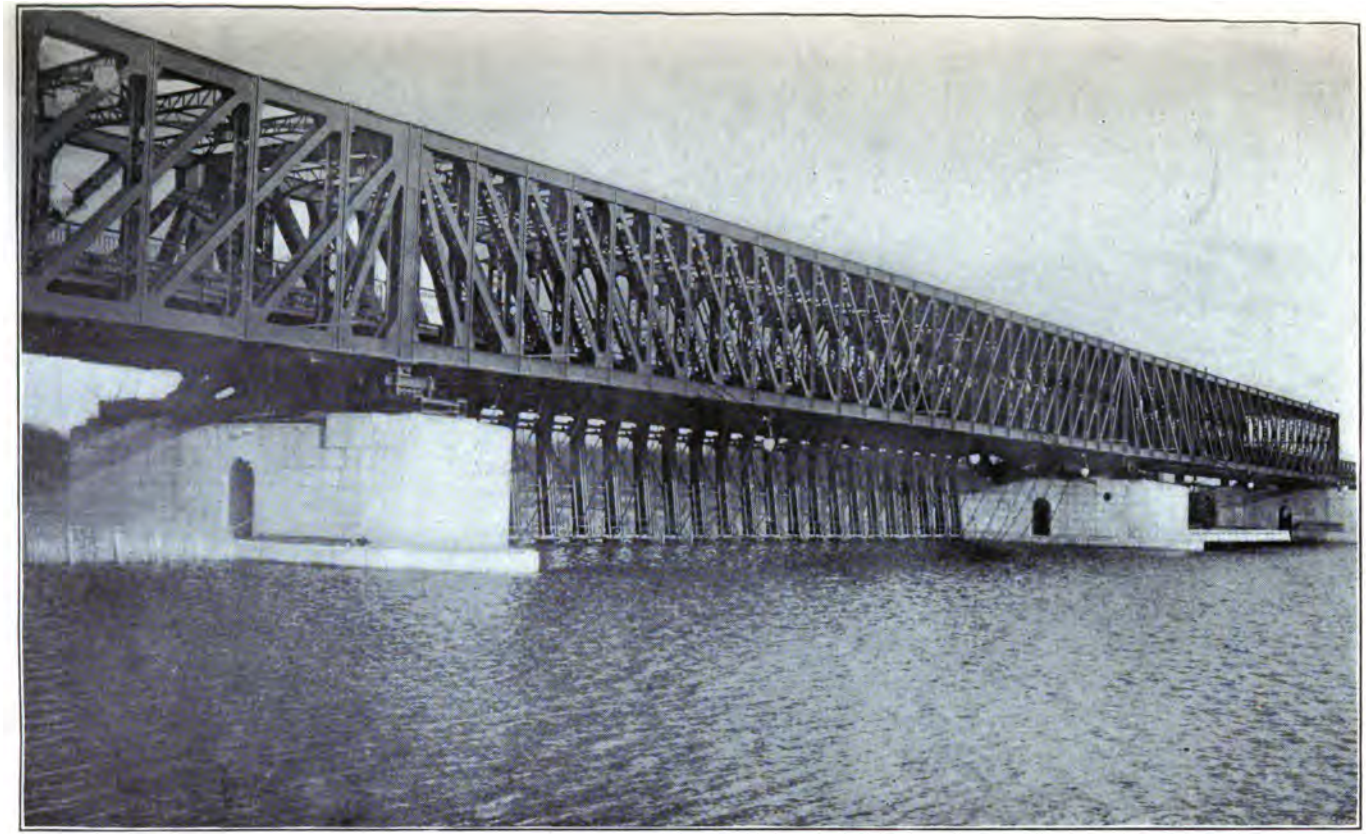

MOVABLE DAM AT MIROWICZ ON THE MOLDAU RIVER, BOHEMIA.

The trestle-and-needle-weirs are shown at the ends and the gates, operated from the bridge, in the center. The dam is in position, the view being from above.

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In one important feature the Mohawk valley is unlike those of most of the western and southern streams, in which movable dams have already been built by the United States Government. Recent geological investigation has deduced the fact that, during the recession to the northeast of the last glacial overflow, the waters of a vast inland lake, which is believed to have covered a large portion of the northern United States, found an outlet through the ridge at Little Falls, and, until the farther retreat of the ice-front opened the channel down the St. Lawrence, the valleys of the Mohawk and Hudson formed the course of a swift, torrential stream. The low ridge at Rome thus became the divide between the St. Lawrence and Mohawk systems, the waters to the east continuing to flow down the Mohawk. Thus it happens that the bed of this river is of very ancient origin, and has a considerably greater proportionate area for passing its present-day floods than is found in the newer streams of the West and the South. Accordingly the floods do not rise so far above its banks, a rise of 20 feet above low water being extremely rare, while 15 feet is a large amount. On the Ohio and Mississippi and their tributaries, on the other hand, flood ranges of 20 feet are common, while extreme floods reach the height of 50 or 60 feet, and even 71 feet was recorded at Cincinnati in 1884.

In the territory which is now northern United States, the valleys of the Hudson and the Mohawk were the great natural highways of travel between the coast and the interior — in use by the Indian long before the coming of Europeans. Along this route the white man established his trading posts, which later grew into hamlets, and here was made the first attempt at opening water communication with the great inland lakes. The marvel of its time — the original Erie canal — turned these hamlets and lonely frontier cabins into thriving cities and flourishing villages, and soon the railways came to increase the prosperity, so that to-day the course of the Mohawk is dotted with the numerous industries of city or village and is lined with valuable farm properties, each bank of the river carrying, also, its great railroad. Any change which might raise the height of floods in a territory thus highly developed would both cause serious injury and annoyance, and would also result in attendant suits for damage. In order to avert the possibility of such an occurrence, movable dams are to be placed in the lower Mohawk, instead of the originally-contemplated fixed dams. By this means it will be possible to control floods,

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and ice outflows, at least to the extent of restoring natural conditions, which could not be accomplished with fixed dams. Since the possibility of increasing the height of a flood need not be feared, a higher water-level for navigation may be maintained, and this results in a higher bottom and so, also, in the saving of material to be excavated. In the winter, too, the dams may be removed, leaving the river as it was before their construction. Again, there will be no opportunity for silt and debris to collect above these movable dams, and they will last longer than the timber fixed type originally planned, which always needs repairing in a few years, from damage by ice, etc.

The careful consideration which has been given to the working out of details in planning for the canal, soon showed that movable dams were necessary, if the problem of canalizing the Mohawk was to be properly solved. Accordingly most pains-taking investigations of existing movable dams were begun; a man was secured to supervise the making of plans, Mr. D. A. Watt, who had a national reputation in such practice; the sites of existing dams were visited not only in America but in Europe, as well, the canal structures on the lower and upper Seine, the Yonne, the Marne, the Oise, the Saône, the Rhone, the Po, the Danube, the Moldau, the Elbe, the Spree, the Main, the Ems, the Rhine and the Thames being inspected; the advice of Major William L. Sibert, U. S. A., now of the Isthmian Canal Commission, and of other experienced engineers was obtained, and thus thorough consideration was given to the whole subject.

The style finally adopted is known as the bridge dam with Boulé gates. As certainty of operation was a prime requisite, this type appeared to be the most suitable. The study of European practice showed that, of the many designs of movable dams that have been tried, two are now recognized as best — the needle-dam and the gate-dam — since they combine in the greatest degree cheapness in first cost and simplicity in operation. It is the testimony of European engineers who have had experience with these and other types of dam that the bridge dam is superior to all for certainty and ease in operating.

In point of cost also the movable system compares favorably with the original plans, which provided for eight fixed dams with a total length of about 9,300 feet and an estimated cost of about $1,880,000. The eight movable dams adopted will have a total length of about 3,650 feet and the preliminary estimated cost was

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MOVABLE DAM AT MIROWICZ ON THE MOLDAU RIVER, BOHEMIA.

View beneath the bridge and above the gates, showing the heavy construction of the frames, the chains for operating the gates and others for raising the frames to a horizontal position under the bridge floor. The gates are lowered to position, serving as a dam.

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about $1,825,000, showing a balance in their favor of $54,000. The greater length of the fixed dams was needed in order to provide as long spillways as possible, so as to reduce the proposed new flood levels; the movable dams adhered closely to the dimensions found in the natural condition of the river width at the various sites, since in floods the obstruction of the dams was to be removed. In point of fact a considerably larger saving in first cost resulted than at first appeared, because the original estimate of 1900 was based on prices of material, etc., which have since largely increased, while the actual contracts for the movable dams were made from 2 to 5 per cent below their preliminary estimated cost. A large saving in channel excavation was also secured, since higher pool levels could be used, as before described, and the amount of land and property permanently endangered from changes in flood and ice conditions was reduced to a minimum, as well as the liability to damage suits from temporary injuries.

In point of operation the movable dams are the more expensive (and this constitutes the chief objection to them) because of the additional men required to work them, while in point of maintenance the difference will probably be slight, as the steelwork is all above water where rusting will be a minimum, and where the metal work can be looked after by the regular employees.

In appearance these dams on the Mohawk (some of which are now being built and all are under contract) will seem to be bridges with abutments and piers, but of somewhat heavier construction than usual. From the down-stream side will hang a series of steel frames, 15 feet apart and hinged at the top, extending to a concrete sill stretching between abutment and pier across the width of the river. Each frame will carry an upper and a lower tier of gates, which are large rectangular steel plates and may be raised or lowered, rolling on a track on the frame and moving somewhat like an ordinary window sash. When serving as a dam the bottoms of the lower gates will all be lowered so as to rest on the foundation in the bed of the stream, the tops of the upper gates forming the crest of the dam and regulating the elevation of the water surface at ordinary stages. When it is desired to let more water escape than will spill over the crest, the gates are partly raised, one or all, and the water rushes through the orifice thus opened. For convenience in regulating the stream, the gates are divided horizontally into two tiers, as before de-

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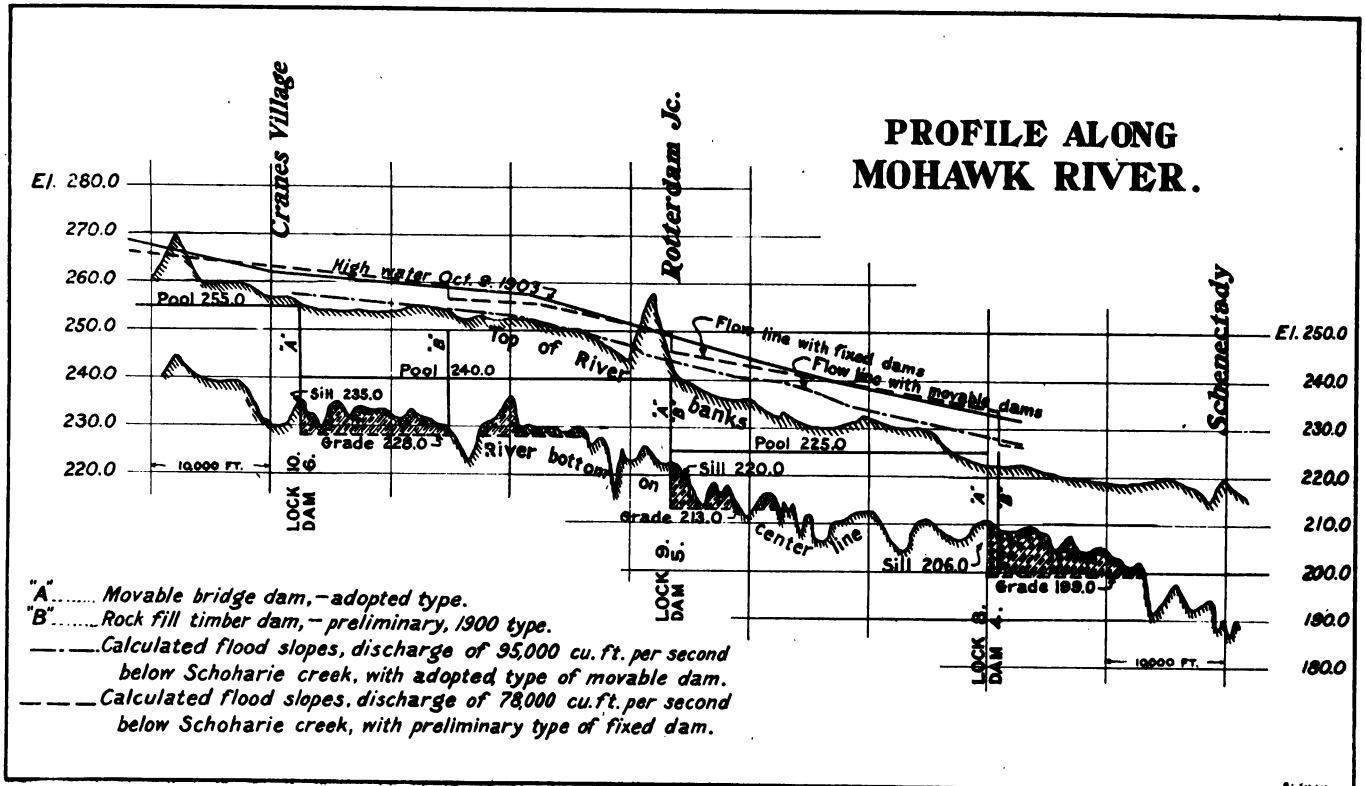

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scribed, which may be raised successively. In time of extreme flood or during the winter season, the frames and gates may both be removed from the stream, leaving an unobstructed channel, simply spanned by a bridge. To accomplish this the frames are attached to the bridge at their tops by a hinge-like joint so that they may be swung up under the bridge floor to a horizontal position, carrying the gates with them.

A maximum depth on the masonry sills was adopted of 20 feet, and a minimum of 16 feet, and the lifts range from 8 to 15 feet. These figures are interesting in comparison with the size of the first movable dam constructed in 1834, where the lift was a little over 3 feet, and the depth on the sill about 6 feet.

In planning for these structures, many features required careful study in order to obtain satisfactory results. To quote the words of the engineer making the plans, "the general principles of the designing, briefly summarized, were to reproduce the natural area of discharge at each site, so as to avoid changing flood heights; to use high dams so as to reduce their number and length and, therefore, their cost; to use few pieces so as to concentrate the strength and reduce the number of pieces to be handled; to place a minimum amount of steelwork permanently under water because of rusting; to make all parts of plain workmanship, etc., and similar as far as practicable; and to incorporate only such features as had been successfully adopted elsewhere, or about whose success there appeared to be no reasonable doubt."

A good example of this type of dam has recently been built at Mirowicz on the Moldau river, Bohemia, having been completed in 1904. As an evidence of the easy operation of gate-dams, the experiences at this place are interesting. This dam was built with three openings, a trestle-and-needle-weir at each side and a pass closed by gates and operated from the bridge in the center. It was intended to use the weirs for regulating the stream and to raise the gates only for floods, but the ease found in regulating by the pass has caused a reversal of the original intention, and the gates are now used for all the regulating and the needles remain in position and untouched except for floods.

The probable effect on the floods that will hereafter occur in the Mohawk valley, would form an interesting part of this discussion. In designing the movable dams there has been no attempt to do much more than replace natural conditions, but another element enters into the calculation which indicates that a

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flood of any given volume will not rise to its former height after the Barge canal has been constructed. The straightening and enlarging of the channel and the removal of obstructions will produce this result. That portion of the river between Schenectady and Crane's Village, may be taken as a typical section for consideration. When the preliminary plans of 1900 were made, a flow of 78,000 cubic feet per second below Schoharie creek was used as the governing maximum discharge, but in October, 1903, there occurred a flood, estimated at 95,000 cubic feet per second at its greatest height, which afforded an excellent opportunity for obtaining high-water elevations along the stream. From a study of flood records on this river for the past ten years it is estimated that a freshet of like dimensions may be expected to occur only once in about one hundred years. Now if the water-surface elevations be calculated for a flow of 78,000 cubic feet with the fixed dams of the preliminary designs, and other calculations be made for a flow of 95,000 cubic feet with the adopted movable dams, it will be seen, by comparing them with the observed elevations of the 1903 flood, that the fixed dams would raise the surface nearly to the elevation of that flood, with a flow only about four-fifths its size, while the larger flood with movable dams will be four or five feet lower.

To illustrate this more graphically a sketch is herewith presented, showing a profile along the river between Schenectady and Crane's Village. This profile gives the proposed locations of the fixed dams and the positions of the movable dams as now being constructed; also the profiles of the river bottom on the center line and of the top of banks, together with lines representing the observed slope of the 1903 freshet, the calculated flood slope for a discharge of 78,000 cubic feet per second with fixed dams, and another for one of 95,000 cubic feet with movable dams. The diagram is self-explanatory; it becomes highly interesting as showing a probable result that will be most acceptable to those who, in the past, have suffered from the floods of the Mohawk.

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MAY, 1908

Barge Canal Bulletin

Series I No. 4

DEPARTMENT OF

THE STATE ENGINEER AND SURVEYOR

OF THE

STATE OF NEW YORK

FREDERICK SKENE, State Engineer and Surveyor

ISSUED MONTHLY UNDER THE AUTHORITY OF THE STATE ENGINEER, BY THE BUREAU OF PUBLICATION AND REPORTS, DEPARTMENT OF THE STATE ENGINEER AND SURVEYOR

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Progress of Contract Work.

A comparison of the total amount of contract work done during the month of April, given below as $219,130, with the corresponding figures of the previous month, amounting to $60,790, shows that contractors generally along the line of the Barge canal have resumed work for the season, although the increased activity would have shown to better advantage had not some of the larger river contracts been held back by the usual high water of the month of April.

The following table shows the number of contracts now under construction, names of the contractors, amounts of the several contracts, value of work done on each during April, total value of work on each done to May 1 and its percentage of the entire contract, which percentage, as we have before stated, is based on the only common unit of comparison — that of money value.

The detailed table of each contract, which appeared last month, is here omitted for lack of space.

Contract No	CONTRACTOR.	TOTAL VALUE OF WORK.			Percentage of work done to May 1, 1908.
		Put under contract.	Done to May 1, 1908.	Done during April, 1908.	
1	Empire Engineering Corporation	*$606,814	$343,190	$4,500	56.6
2	The Ferguson Contracting Company	*902,145	474,110	6,000	52.5
3	Sundstrom & Stratton	*657,273	511,350	180	77.9
4	Empire Engineering Corporation	*725,065	223,390	4,840	30.8
5	Empire Engineering Corporation	*375,872	125,820	0	33.5
6	Frank A. Maselli	*1,022,601	523,480	8,310	51.2
7	Groton Bridge Company	*97,537	59,970	6,120	61.5
8	Pittsburg-Eastern Company	*1,434,755	149,000	2,610	10.4
9	Thos. Crimmins Construction Company	755,995	0	0	0
10	Mosier & Summers	*1,107,610	114,780	8,650	10.4
11	Fort Orange Construction Company	*1,343,165	268,650	18,020	20.0
12	Stewart-Kerbaugh-Shanley Company	3,391,716	2,970	2,970	0.1
14	Acme Engineering & Contracting Company	2,935,763	25,420	8,210	0.9
15	Atlantic, Gulf & Pacific Company	*1,520,547	240,850	57,600	15.8
16	United Construction Company	63,473	0	0	0
17	Alexander Murdoch	**836,643	57,560	0	6.9
18	O'Brien & Hoolihan Contracting Company	*861,599	176,870	22,440	20.5
19	Great Lakes Construction Company	1,000,497	58,050	6,860	5.8
25	Atlantic, Gulf & Pacific Company	*1,717,649	149,790	37,210	8.7
26	Lake Erie Dredging Company	59,795	0	0	0
27	Kinser Construction Company	*943,540	88,880	22,880	9.5
34	M. Fitzgerald	*22,449	17,990	20	80.0
35	Gilmour-Horton-Allen Company	739,261	5,830	1,710	0.8
45	Scott Brothers	467,514	0	0	0
	Totals	$23,589,278	$3,617,950	$219,130	

* Includes all alterations in force to date.
** Includes all alterations in force to date, except the last.

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Total Amount of All Kinds of Construction Work, to May 1, 1908.

Similar kinds of work are grouped under one heading; an enumeration of the items grouped is shown in the foot-notes.

Contract Number.	Excavation.*a*	Embankment.*b*	Concrete.*c*	Dry stone work.*d*	Sawed lumber.*e*	Round timber.	Piles.	Iron and steel.*f*	Iron and steel.*g*	Miscellaneous items of work.*h*	Miscellaneous construction items.*i*	Extra and unspecified work.*j*	Extra and unspecified work.*k*
	Cu. yds.	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*	*Ft. B. M.*	*Lin. ft.*	*Number.*	*Lbs.*					
1	532,119	11,764	3,574	3,437	23,307	38,857	0	0	0	$288	0	0	0
2	363,641	20,812	52,537	0	25,023	0	1,488	226,329	$1,290	14,608	$3,140	0	$1,316
3	755,649	92,764	26,617	3,679	30,781	0	16	163,552	0	6,149	676	$3,713	36,044
4	1,053,671	37,270	1,621	8,082	553,700	109,375	2,571	37,778	0	12,110	0	0	1,257
5	901,601	10,649	1,770	518	56,457	0	36	0	0	2,862	153	0	0
6	1,117,417	28,899	498	0	0	0	0	0	0	560	46	0	0
7	0	0	93	2	66,712	0	0	1,162,272	0	0	1,552	0	0
8	118,951	3,500	7,281	0	24,750	0	3,588	14,123	462	200	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0
10	110,506	220	2,370	940	57,500	0	0	572	0	0	1,012	0	0
11	290,793	56,014	20,232	2,243	178,595	0	333	125,189	0	1,336	2,688	0	0
12	9,234	0	0	0	0	0	0	0	0	132	0	0	0
14	34,561	0	0	0	0	0	0	0	0	30	0	0	0
15	700,402	1,736	4,536	0	24,901	0	2,453	37,238	240	258	9	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0
17	40,964	1,615	1,322	2,321	4,348	0	373	11,811	0	200	573	0	0
18	192,555	97,959	9,663	292	969	0	136	16,539	0	800	500	8,410	0
19	201,750	0	0	0	0	0	0	0	0	0	0	0	0
25	646,567	0	0	0	0	0	0	0	0	1,022	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0
27	250,468	280	3,024	0	80,523	0	0	7,494	0	276	0	0	0
34	0	0	0	0	0	0	0	345,013	0	0	2,513	0	0
35	4,280	0	119	0	0	0	0	1,820	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals	7,325,129	363,482	135,257	21,514	1,127,566	148,232	10,994	2,149,730	$1,992	$40,831	$12,862	$12,123	$38,617

a Includes earth and rock excavation and grubbing. *b* Includes embankment and puddle. *c* Includes concrete (all classes) and grouted filling. *d* Includes ballast, dry retaining wall, wash-wall, lining, riprap and stone filling in cribs. *e* Includes sawed lumber (all kinds), wooden sheet-piling and sheeting and bracing. *f* Includes chains, iron castings (plain or machined), iron pipe and specials, metal reinforcement, steel and iron fastenings, steel castings, structural steel and wrought iron. *g* Includes items paid for by the piece — fender fastenings, gate-hoists, lock-gates, needle-dams, valves, valve-seats and valve-supports. *h* Includes bailing and draining, clearing, extra labor on forms and finishing concrete, removing concrete, dressing concrete, maintaining traffic, overhaul and removing revetment. *i* Includes channeling, cut stone work, iron railings, paving (all kinds), removing existing structures, repairs to local sewers, etc., sidewalks and curbs, steel sheet-piling, trenching and backfilling, vitrified pipe and wooden fencing. *j* At contract prices. *k* At cost, plus a fixed percentage.

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Detailed Account of Contract Work for April.

An account of what was accomplished during April, 1908, on each piece of work under contract will be found in the following list, under its respective contract number. The order followed is one of location. Beginning at Waterford the pieces of work on the Erie canal are given in their order toward the west to Buffalo; and the contracts on the Champlain and Oswego canals, in order from south to north, follow.

Erie Canal.

Contract No. 2.

For prism excavation and construction from Mohawk river at Waterford, west, including Locks 2 and 3, to a point about one-fourth mile west of the latter.

The steam shovel resumed work on April 20, near the upper end of the contract, and removed one cut from Station 214 to 220. About 3,894 cubic yards of material were removed and placed in embankment and spoil bank in rear of north core-wall of Lock No. 3. A small amount of excavation was done at each of the following places, totaling 2,684 cubic yards; foundation for wing-wall of north abutment of Fourth street bridge; foundation for spillway and core-wall of Lock No. 3; for approach-walls of Lock No. 3 and for upper thrust-wall of Lock No. 2. At the latter place the water in the river rose on April 20, and no work has been done there since, as the river is still high.

A small amount of embankment was laid back of the south wall of Lock No. 2, on the approaches to Saratoga avenue and Fourth street bridges and at the core-wall of Lock No. 3.

Concrete was laid at the following places, all being mixed by hand: areaways on Fourth street bridge approach, west wing-wall on north abutment of Fourth street bridge, north core-wall and spillway at Lock No. 3, aggregating 738 cubic yards.

Coping stone for the south side of Saratoga avenue bridge was delivered. Percentage of work to date is 52.5.

Contract No. 34.

For steel highway bridge over Erie canal at Waterford.

Coping stone for south abutment set; hand rail, due to changed location, completed; 6½ panels of forms for concrete floor completed. Percentage of work to date is 80.0.

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Contract No. 11.

For prism excavation, and construction from Contract No. 2 to Mohawk river below Crescent, including Locks 4, 5 and 6, highway, bridge abutments, guard-gate masonry, etc.

Steam shovels *Vulcan* and *Bucyrus* removed 13,060 cubic yards, the latter being moved later to the vicinity of Lock No. 4 and removing 1,480 cubic yards in addition, which were placed in embankment in rear of core-wall. Channeling, about 1,310 square feet. About 1,200 cubic yards of concrete were placed. Percentage of work to date is 20.0.

Contract No. 7.

For twelve steel highway bridges at various points on Contracts Nos. 2, 3, 4, 5 and 6. Shop drawings for all 12 bridges have been completed and approved. Lee Road bridge now being fabricated at shops. About 946 tons of steel have been rolled at mills and delivered to shops.

Fourth street bridge, Waterford. Work resumed on 23d; concrete forms removed from roadway; sidewalk forms begun.

Payne's, Fort Miller and Ridge Road bridges. No change during the month.

Mosquito Point bridge. Broken top chord repaired and placed, completing erection of superstructure, except hand rail. Eighty per cent of riveting done; one-fourth first coat of paint on; nailing strips one-half laid; an increase of 71,097 lbs. of structural steel.

Sylvan Beach bridge. Completed except coat of paint and approach railings. As the approaches are not yet constructed, the construction force was withdrawn on the 21st, until ready to place railings.

Percentage of work to date is 61.5.

Contract No. 16.

For eleven steel highway bridges, ten of which are at various points on Contracts Nos. 25 and 27, Champlain canal, and the remaining one on Contract No. 11, Erie canal. In order to facilitate the progress of prism excavation on Contracts Nos. 25 and 27, the bridges on these contracts will not be built until 1909. About 395 tons of steel have been rolled at mills and delivered to shops.

Contract No. 14.

For work from Contract No. 11 to a point near Rexford Flats aqueduct, including Lock No. 7 and Dams Nos. 2 and 3; also in-

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cluding Locks Nos. 13, 14 and 15, Dams Nos. 9, 10 and 11, Mindenville retaining dam, etc.

At Dam No. 2, at Crescent, erecting buildings, receiving supplies, setting up excavator and mixer and grading construction railroad.

At Lock No. 7, Dam No. 3, at Vischer's Ferry, excavating at lock and lower approach. About 10,000 cubic yards of material deposited in spoil area west of lock.

At Lock No. 15, Dam. No. 11, at Fort Plain, excavating 900 cubic yards, deposited in spoil south of lock and 1,200 cubic yards for earth coffer-dam at site of lock. Percentage of work to date is 0.9.

Contract No. 8.

For constructing Dam No. 4 and Lock No. 8, at Scotia; Dam No. 5 and Lock No. 9, at Rotterdam; Dam No. 6 and Lock No. 10, at Crane's Village, all on the Mohawk river.

Lock No. 10, Dam No. 6. Work has been progressing nearly all the month on the coffer-dam and sand washer. The latter is ready for trial.

Lock No. 9, Dam No. 5. Began pumping out lock pit on 14th. On 18th began to operate steam shovel and to drive piling. About 1,700 cubic yards have been excavated from lock pit, of which 250 cubic yards have gone into a coffer-dam. Two hundred and twenty-six piles have been driven in breast-wall and upper end of lock. Percentage of work to date is 10.4.

Contract No. 17.

For constructing Dam No. 7 and Lock No. 11, at Amsterdam, and Dam No. 8 and Lock No. 12, at Tribes Hill.

Lock No. 11, Dam No. 7. Construction work for the season commenced on the 11th with back filling and puddle wall at south abutment. Pile trestle for coffer-dam, lower guide-wall, commenced on 15th; 200 feet completed. Upper guide-wall coffer-dam: about 300 feet cribbing and single lap piling driven. Twelve foundation piles, upper guide-wall, driven.

Lock No. 12, Dam No. 8. Small excavation for lock cut-off wall in progress. South side, 250-foot coffer-dam trestle completed, 40 feet sheet-piling on upper side and 3 or 4 bents on downstream side driven. About 40 feet cribbing for upper guide-wall coffer-dam in place. Percentage of work to date is 6.9.

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Contract No. 18.

For excavating prism, Mindenville to Castle Creek; constructing Lock No. 16, dam at Castle Creek and incidental structures.

Twenty per cent of clearing completed. Grubbing to the extent of 1,791 cubic yards completed.

Excavation in progress: for contractor's boat slip on south side of temporary canal, from which sand has been used for concrete and the remainder placed behind south lock-wall; rock excavation at lock-wall foundation for 165 feet; earth excavation and embankment at various points on the prism.

Concrete laying on both lock-walls progressing; amount of second-class concrete laid during month, 1,119 cubic yards, second-class concrete used in place of grouted filling, 125 cubic yards. Stone crusher for concrete erected.

Several bridges on this contract are in process of removal. Considerable work has been done in the way of clearing up the site and preparing for navigation on the Erie canal. Percentage of work to date is 20.5.

Contract No. 4.

For excavating prism from Oneida lake about four miles east; constructing bridge foundations, stream entrances, crib and pile docking, breakwater and guard-pier in Oneida lake, etc.

The Lubecker has been steadily working during the month along the north side, building levees, supplemented by a small force of men. The concrete approach to the north side of the Sylvan Beach bridge has been started and is proceeding satisfactorily.

In the log yard, cribs have been built; the dredge *Owego* is deepening the channel to the breakwater that the cribs may be more readily floated to position, but none have been placed, owing to extremely high water in the lake; forms have been built for making concrete blocks for the breakwater.

The following progress has been made during the month: All excavation, 16,737 cubic yards; forming embankment, 16,738 cubic yards; stone filling, 223 cubic yards; second-class concrete, 28 cubic yards; first-class concrete, 27 cubic yards; steel reinforcement, 1,835 lbs.; extra labor and forms, $59.87; overhaul on additional excavation, 568 cubic yards. Percentage of work to date is 30.8.

Contract No. 12.

For excavating prism between Oneida lake and Mosquito Point bridge on Seneca river; constructing Lock No. 23 and other structures.

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At Brewerton, the plant has been assembled. At Anthony Cut, excavation has begun and about 9,000 cubic yards have been moved. Six acres have been cleared. Percentage of work to date is 0.1.

Contract No. 45.

For the construction of a dam in the Oneida river at Caughdenoy and of Lock No. 24 and appertaining structures at Baldwinsville.

Contract was awarded to Scott Brothers, of Atlanta, Ga., on April 23, for $467,513.50. No construction work done yet.

Contract No. 5.

For prism excavation, construction of Owasco creek entrance, bridge foundations at Mosquito Point, Sibley's and Fox Ridge highway crossings, etc.

No contract work done during the month. The work of removing the plant from the site of the contract has continued until there is practically no plant left. Percentage of work to date remains at 33.5.

At a meeting of the Canal Board on April 23, the subject of the suspension of work on this contract was considered, but, pending further investigation, no decisive action was taken.

Contract No. 6.

For prism excavation, and construction of five bridge foundations between a point just south of Buffalo road and another point near South Greece and northwest of Rochester.

Steam shovel No. 2, which has been submerged in cut west of Lyell road since last December has been so far relieved of water as to be repaired, and resumed work April 14 between Stations 2635 and 2648. The conveyor resumed work on the 15th — after the fire which destroyed its trolley car — at Stations 2262–2666. Excavation for the month, 18,795 cubic yards. Percentage of work to date is 51.2.

Contract No. 9.

For prism excavation and structures between a point near Eagle Harbor and a point near Beal's bridge.

Contractors assembling plant. Hoist engines and derricks erected at Beal's, Knowlesville, Long's and Allen's bridges and temporary approaches to abutments at Beal's and Knowlesville bridges built. Engine, climax crusher and bin with rotary screen erected at Knowlesville bridge, at which point 200 cubic yards of stone for crushing have been delivered and 75 yards of exca-

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vation at south abutment made. Contractor's office opened at Knowlesville. No estimates yet.

Contract No. 19.

For prism excavation, rebuilding bridges, constructing masonry culvert, concrete-capped pile docking, etc., between Sulphur Spring guard-lock and mouth of Ellicott creek.

Contract work was resumed April 13, and by the 17th four machines were in operation. The Lidgerwood cableway excavated 6,757 cubic yards, the derrick excavator and Page bucket, 5,205 cubic yards, the other derrick excavator — *Long Tom* — 5,765 cubic yards, and the clam shell *Lawton*, 5,068 cubic yards. Total excavation 22,795 cubic yards. Percentage of work to date is 5.8.

CHAMPLAIN CANAL.

Contract No. 1.

For dredging Hudson river channel from Northumberland to Fort Miller and from Crocker's Reef to Fort Edward; constructing Crocker's Reef dam and approaches to "Land Line," etc.

During the month the dredge *Pontiac* has worked eight days forming dike from Billings island northerly; fifteen days excavating mostly rock about one-fourth mile north of the island, and three days excavating south of mouth of Snooks kill. The *Peconic* is being dismantled for removal through the Champlain canal to the south end of the contract. The rock breaker has been in operation nearly the entire month about one-fourth mile north of Billings island. Two steam tugs have been in use nearly all the month towing scows. Much difficulty has been encountered due to extreme high water during the greater part of the month. Percentage of work to date is 56.6.

Contract No. 3.

For excavating prism from Fort Miller to Crocker's Reef, constructing Lock No. 6, guard-gate, bridge foundations, etc.

The remaining rock in the west side cut at Stations 163–165+50 has been drilled and blasted but not removed. One hundred and three cubic yards of gravel have been placed on Ridge street bridge approaches for lining, completing this item of the preliminary estimate. Eight hundred and forty feet of fence at this point have been painted one coat. Percentage of work to date remains at 77.9.

Contract No. 26.

For dredging Hudson river channel between Fort Edward and north end of Contract No. 1. No construction work done yet.

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Contract No. 27.

For work between Dunhams Basin and Fort Edward, including Locks Nos. 7 and 8, junction lock, spillways, power plants, concrete arch bridge, etc.

Excavation: the derrick at Cary's has taken out about 6,000 cubic yards of material; 500 cubic yards of rock have been removed at Lock No. 8; concrete has been laid at the junction lock; 300 cubic yards of back filling are in place and a wheel grader operated by 12 mules has excavated about 3,500 cubic yards at Lock No. 7. Percentage of work to date is 9.5.

Contract No. 25.

For prism excavation between 0.6 mile north of Comstock post-office and highway crossing at Dunhams Basin; constructing Lock No. 9, spillways, power plants, etc.

Excavation for the month: dredge *Fort Edward,* 154,666 cubic yards; towers, 11,138 cubic yards; Page bucket machine, 6,187 cubic yards; other excavation, 1,104 cubic yards. Percentage of work to date is 8.7.

Contract No. 15.

For prism excavation, and constructing Lock No. 11, Dam No. 4; Lock No. 12, Dam No. 5; spillway, culverts, highway, bridges and other structures between 0.6 mile north of Comstock post-office and Lake Champlain at Whitehall.

Dredge *Champlain* began excavating prism on 9th, about 1,000 feet north of guard-lock; about 120,673 cubic yards excavated. The *McMyler* began excavating a half mile farther north, removing 7,343 cubic yards. Other earth excavation amounted to 2,874 cubic yards. Three hundred and thirty-one cubic yards of rock excavated at Lock No. 12, Whitehall. Dykes built to the extent of 605 cubic yards.

At Lock No. 12, 3,147 cubic yards second-class concrete laid in east wall. Forms being built and 1,130 cubic yards of stone crushed.

Also constructing temporary bridge, coffer-dam, driving piles and piling, back filling and deepening Champlain canal for contract use. Percentage of work to date is 15.8.

OSWEGO CANAL.

Contract No. 10.

For prism excavation, constructing Locks Nos. 2 and 3, dams, bulkheads, etc., at Fulton.

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Excavation progressing at several points to the amount of 7,400 cubic yards. Wash-wall on west side nearly completed for about 250 feet. Percentage of work done is 10.4.

Contract No. 35.

For prism excavation, and constructing Locks Nos. 7 and 8, bulkheads, culverts, spillways, etc., between a point one-half mile above Utica street bridge and harbor line north of Bridge street bridge at Oswego.

Excavation in canal bottom between Locks Nos. 7 and 8 and for foundations west wall and bridge pier,—earth, 500 cubic yards, rock, 180 cubic yards. One hundred and twenty cubic yards concrete laid and 1,820 pounds metal reinforcement used. Old bridge at Utica street nearly removed.

At lock No. 8, a coffer-dam to enable work to be continued during canal navigation has been under construction. Percentage of work to date is 8.10.

List of Barge Canal Contractors, with their Addresses.

On account of frequent inquiries concerning the contractors who are building the Barge canal, it is thought wise to insert the following table, which gives the names and post-office addresses of the several contracting firms and the numbers of the contracts on which they are engaged.

Contract No.	CONTRACTOR.	Address.
1	Empire Engineering Corporation	60 Wall street, New York, N. Y.
2	The Ferguson Contracting Company	69 Wall street, New York, N. Y.
3	Sundstrom & Stratton	90 West street, New York, N. Y.
4	Empire Engineering Corporation	60 Wall street, New York, N. Y.
5	Empire Engineering Corporation	60 Wall street, New York, N. Y.
6	Frank A. Maselli	428 Granite building, Rochester, N. Y.
7	Groton Bridge Company	Groton, N. Y.
8	Pittsburg-Eastern Company	Cannon place, Troy, N. Y.
9	Thos. Crimmins Construction Company	444 East 69th street, New York, N.Y.
10	Mosier & Summers	1266 Seneca place, Buffalo, N. Y.
11	Fort Orange Construction Company	112 State street, Albany, N. Y.
12	Stewart-Kerbaugh-Shanley Company	527 Fifth avenue, New York, N. Y.
14	Acme Engineering & Contracting Company	Parker Bldg., Schenectady, N. Y.
15	Atlantic, Gulf & Pacific Company	Park Row building, New York, N. Y.
16	United Construction Company	467 Broadway, Albany, N. Y.
17	Alexander Murdoch	Fidelity building, Baltimore, Md.
18	O'Brien & Hoolihan Contracting Company	1722 Park street, Syracuse, N. Y.
19	Great Lakes Construction Company	Buffalo, N. Y.
25	Atlantic, Gulf & Pacific Company	Park Row building, New York, N. Y.
26	Lake Erie Dredging Company	Buffalo, N. Y.
27	Kinser Construction Company	Fort Edward, N. Y.
34	M. Fitzgerald	Hoosick Falls, N. Y.
35	Gilmour-Horton-Allen Company	Sandy Hill, N. Y.
45	Scott Brothers	Atlanta, Ga.

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Detailed Account of Plans Being Prepared.

The following is a detailed account of the plans in process of preparation at the main and residency offices. An order according to location is followed, as explained in the account of work under contract.

Erie Canal.

Contract No. 32.

For needle-dams on Contracts Nos. 2, 11 and 27. Plans under way.

Contract No. 20.

For dredging a channel in the Mohawk river and performing work incidental thereto between Rexford Flats and Little Falls. Length, about 58 miles. Plans recalled from Canal Board by the State Engineer for alterations.

Contract No. 30.

For dredging channel in Mohawk river and land line from Little Falls to Sterling creek, constructing lock at Jacksonburg, dam and guard-gates at Herkimer, bridges, stream entrances, etc. Plans 80 per cent completed.

Contract No. 29.

For excavating prism from Sterling creek to Herkimer-Oneida county line, constructing lock at Sterling creek, bridges, stream entrances, etc. Plans 80 per cent completed.

Contract No. 43.

For work between Oriskany and Contract No. 4. Completion of plans delayed by reason of certain decisions as to location.

Contract No. 22.

Bridges on Contract No. 12. Plans under way.

Contract No. 57.

Syracuse Harbor. Preliminary studies made. The municipal authorities of Syracuse have recently procured the passage of a bill by the Legislature, providing for increased harbor facilities, including a turning basin, which bill is now before the Governor.

Contract No. 46.

For prism excavation, and construction of a lock, a movable dam and bridges between Fox Ridge and the south line of Wayne county. Plans 95 per cent done.

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Contract No. 47.

For work between the south line of Wayne county and Geneva street, Lyons, including prism excavation, a lock, a fixed dam and bridges. Plans 60 per cent completed.

Contract No. 48.

For prism excavation, and building of structures from Geneva street, Lyons, to Port Gibson. Surveys under way.

Contract No. 49.

For excavating prism, and building structures between Port Gibson and the Wayne–Monroe county line. Preliminary surveys made.

Contract No. 63.

For work between the Wayne–Monroe county line and Kings Bend, west of Pittsford. Surveys in progress.

Contract No. 23.

For prism excavation, constructing Locks Nos. 32 and 33 and appurtenant structures, culverts, bridge foundations, etc., between Kings Bend and east bank of the Genesee river. Plans 65 per cent done.

Contract No. 21.

For prism excavation, and constructing bridge foundations, etc., between point just north of Scottsville road and another point just south of Buffalo road and south of Rochester, dredging Genesee river, constructing guard-lock, guard-gate and controlling dam at Genesee river crossing. Plans 50 per cent completed.

Contract No. 61.

For prism excavation, and construction of culverts, bridge substructures, etc., between a point 0.5 mile west of Adam's Basin bridge and Monroe–Orleans county line. Plans well under way.

Contract No. 62.

For prism excavation, and construction of culverts, bridge substructures, etc., between Orleans–Monroe county line and a point near Eagle Harbor bridge. Plans under way.

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Contract No. 65.

For work from the west end of Contract No. 9, at a point near Beal's bridge to the east end of Contract No. 64, at a point 600 feet west of Prospect street bridge, Medina, including aqueduct at Oak Orchard creek crossing. Borings and plans under way.

Contract No. 66.

For prism excavation, constructing substructures and approaches for bridges, culverts, etc., from 100 feet east of Gasport bridge to foot of locks at Lockport. Plans completed.

Contract No. 67.

For construction of Locks Nos. 34 and 35, and approaches, etc., at Lockport. Plans under way.

Contract No. 40.

For prism excavation, constructing substructures and approaches for bridges, etc., from head of locks at Lockport to Sulphur Spring guard-lock. Plans under way, the general plans, exclusive of structures, being nearly completed.

CHAMPLAIN CANAL.

Contract No. 69.

For constructing Lock No. 1 and Dam No. 1, above Waterford; and Lock No. 2 below Mechanicville. Plans begun.

Contract No. 68.

For constructing Lock No. 3, at Mechanicville; making prism excavation and constructing Lock No. 4, at Stillwater; prism excavation and Lock No. 5, at Northumberland. Plans 90 per cent completed.

Contract No. 70.

For dredging in the Hudson river from Waterford to Northumberland, approximate length, 24.7 miles. Plans 50 per cent done, but work on them suspended in order to expedite progress on Contracts 68 and 69.

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Contract No. 24.

For constructing guard-gate at Crocker's Reef. Plans completed as far as possible, pending certain decisions of the Canal Board.

Contract No. 56.

Glens Falls Feeder. Plans 25 per cent done.

OSWEGO CANAL.

Contract No. 39.

For dredging channel in Oswego river, constructing stream entrances, excavating through Hinmansville cut-off, etc., between Phœnix and Oswego, except portions covered by Contracts Nos. 10 and 37. Plans 80 per cent done, but suspended pending decisions on Contract 37.

Contract No. 37.

For prism excavation, and constructing Locks Nos. 1, 4 and 5, and Dam No. 4, bulkhead and head-gates, guard-gates and dike, etc., near Minetto, Dam No. 1, at Phœnix, and removing existing dam at Battle Island. Work on plans suspended, pending certain decisions.

WATER-SUPPLY.

Contract No. 50.

For constructing dam, waste-gates and spillway across West Canada creek at Hinkley. Plans under way.

Contract No. 51.

For constructing a diverting dam and feeder to Nine Mile creek watershed. Plans under way.

Contract No. 52.

For constructing a dam on Nine Mile creek, Oneida county. Plans under way, but suspended, pending certain decisions.

Contract No. 55.

For constructing a dam, waste-gates and spillway, four locks, Black river canal aqueduct over Mohawk river, and relocation of Black river canal at Delta. Plans completed.

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Contract No. 58.

For constructing a dam, waste-gates and spillway across Limestone creek, at High Bridge, Onondaga county. Plans under way, but suspended, pending certain decisions.

Plans before Advisory Board.

Contract No. 31.

For prism excavation at Little Falls, constructing Lock No. 17 and Rocky Rift dam. Plans approved at the meeting of April 28–30. Ready for Canal Board.

Contract No. 64.

For improvement from 600 feet west of Prospect street bridge, Medina, to 100 feet east of Gasport bridge. New length, 9.91 miles. Engineer's estimates $1,207,930. Recalled from Canal Board, the east end taken from it and added to Contract No. 65, and again approved by the Advisory Board, April 30; ready for Canal Board.

Contract No. 28.

For constructing an apron at Crocker's Reef dam. Plans approved by the Advisory Board, April 14.

Plans before Canal Board.

Contract No. 42.

For prism excavation, and construction of Lock No. 20, stream entrances, spillway, bridge and other structures, between Herkimer-Oneida County line, near Utica, and Oriskany.

Plans have been before the Canal Board for some time, pending certain decisions in regard to Contract No. 43. At a meeting of the Board on April 30, the request of the State Engineer to withdraw the plans was granted.

Contract No. 60.

For prism excavation, and construction of culverts, bridge structures, etc., between a point 1.75 miles east of South Greece and a point 0.5 mile west of Adam's Basin bridge. Plans approved by the Canal Board at the last meeting in April; ready for letting.

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Recapitulation — Progress on Plans.

Contract No.	DESCRIPTION.	Canal.	Progress on Plans.
20	Rexford Flats to Little Falls	Erie	Plans recalled. Alterations.
21	Genesee river, west 2.56 miles	Erie	50 per cent completed.
22	Bridges on Contract 12	Erie	Under way.
23	Kings Bend to Genesee river	Erie	65 per cent completed.
24	Guard-gate at Crocker's Reef	Champlain	Suspended, pending decisions.
28	Apron, Crocker's Reef dam	Champlain	Approved by Advisory Board.
29	Sterling creek to near Utica	Erie	80 per cent. completed.
30	Little Falls to Sterling creek	Erie	80 per cent completed.
31	Prism at Little Falls, lock and dam	Erie	Completed. Approved by Advisory Board.
32	Needle-dams on Contracts 2, 11 and 27	Erie and Champlain	Under way.
37	Three Rivers to Oswego—structures, except on 10 and 35	Oswego	Suspended pending decision.
39	Three River Point to Oswego—dredging	Oswego	80 per cent completed, suspended pending decision.
40	Lockport to Sulphur Spring	Erie	Under way.
42	Utica to Oriskany	Erie	Withdrawn from Canal Bd.
43	Oriskany to Contract 4	Erie	Awaiting decision as to location.
46	Fox Ridge to Wayne Co. line	Erie	95 per cent completed.
47	Wayne Co. line to Lyons	Erie	60 per cent completed.
48	Lyons to Port Gibson	Erie	Surveys under way.
49	Port Gibson to Wayne-Monroe line	Erie	Preliminary surveys made.
50	Hinckley reservoir—water-supply	Erie	Under way.
51	Nine Mile creek diversion, dam and feeder	Erie	Under way.
52	Nine Mile creek and reservoir	Erie	Suspended, pending decisions.
55	Delta, dam and reservoir—water-supply	Erie	Completed.
56	Glens Falls feeder	Champlain	25 per cent completed.
57	Syracuse harbor	Erie	Preliminary studies made.
58	Limestone creek reservoir, High Bridge	Erie	Suspended, pending decisions.
60	South Greece to Adam's Basin	Erie	Ready for letting.
61	Adam's Basin to Monroe-Orleans line	Erie	Well under way.
62	Monroe-Orleans line to Eagle Harbor bridge	Erie	Under way.
63	Wayne-Monroe line to Kings Bend	Erie	Surveys in progress.
64	West from Contract No. 9 to Gasport	Erie	Recalled, changed and approved by Advisory Board
65	Aqueduct and bridges at Medina	Erie	Borings and plans under way
66	Gasport to foot of Lockport locks	Erie	Completed.
67	Lockport locks	Erie	Under way.
68	Prisms and locks at Stillwater, Mechanicville and Northumberland	Champlain	90 per cent completed.
69	Lock and dam above Waterford and lock below Mechanicville	Champlain	Begun.
70	Dredging, Waterford to Northumberland	Champlain	50 per cent completed, suspended to expedite 68 and 69.

Contract Let.

Contract No. 45.

For the construction of Caughdenoy dam in Oneida river, and of Lock No. 24 and appertaining structures at Baldwinsville. Length, 0.55 mile. Contractor's bid $467,513.50. There was but one bidder, Scott Bros. of Atlanta, Ga., to whom the contract was awarded.

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Canalizing the Hudson, Troy to Waterford.

In the March number of the *Barge Canal Bulletin* announcement was made of the preparation of a memorial to the Congress of the United States, asking for aid in canalizing the Hudson between Congress street, Troy, and the beginning of the Barge canal at Waterford. Recently this memorial was presented at a hearing before the Committee on Rivers and Harbors.

In order that it may be generally known what strong arguments may be adduced in support of the State's claim for Federal aid and also how little, relatively, New York has received from the general Government, it seems fitting to repeat here some of the facts set forth in this memorial.

But first we may consider briefly the history of this project. In his annual message to the Legislature of 1905, the Governor called attention to the fact that New York's share of the millions appropriated for rivers and harbors was but triffling compared with the percentage which her commerce bears to the whole commerce of the United States, and he suggested that our representatives in Congress be requested to press the claims of the State for larger appropriations. About a year later this was followed by an appeal from the State Engineer for the Government to undertake the canalization of the Hudson between Troy and Northumberland. Thus far these appeals have resulted only in the making of a survey and estimate of cost for improving that portion of the river from Troy to Waterford. The report of the Chief of Engineers was presented to Congress on January 21, 1907, accompanied by a letter from the Board of Engineers for Rivers and Harbors, in which it was stated that the Board "believes that the cost of the improvement is reasonable when compared with the benefits reasonably expected to result therefrom, and that it is advisable to extend the existing project in accordance with the plan proposed." It is for this smaller portion between Troy and Waterford, estimated to cost $1,124,100, for which petition is now being made.

One of the strongest arguments for Government assistance is the relatively large volume of New York's commerce and the small amounts of money appropriated for her benefit. A study of the amount of foreign commerce passing through New York in comparison with the proportion of Federal expenditures which the State receives, seems to justify the central Government in coming to the aid of the State of New York at this time. For

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example, in the year 1906 its combined export and import trade was practically equal to the sum total of all the combined export and import trade of the remaining 90 per cent (by population) of the United States; yet this State received, as a return benefit with which to maintain its facilities for handling its immense contribution to the commerce of our country, less than five per cent of the total expenditures for river and harbor improvement. If, as a Federal statesman has said, "The General Government improves channels and harbors and imposes a charge upon commerce with a view to obtaining compensation for the improvements," is it right that a State furnishing, as did New York in 1906, sixty-three per cent of the imports of the Union, the item upon which this "charge" is based, should yet recover less than five per cent of the resulting expenditures for "improvements"? If the figures for a long term of years are considered the result is substantially the same. The total appropriations of the United States Government for river and harbor improvement from 1802 to 1906, inclusive, as compiled approximately from the Chief of Engineers' Reports and other sources, amount to more than half a billion dollars. Yet during this period only about $36,466,000, or 7 per cent, has been appropriated for projects within the State of New York.

Moreover, statistics show that New York has commercial interests comparable with those of any foreign nation and that in the volume of her traffic, per capita, she is surpassed by only one people on the face of the earth.

Not only, however, is it indisputably true that the Federal allotments to the State of New York are quite out of proportion to her contributions to the trade and revenues of the country, but it is even a fact that she has received less than her just measure of the appropriations on the basis of distribution according to population. Her share of the expenditures for rivers and harbors for twelve years, from 1895 to 1906, inclusive, was $14,899,060. With a population of 8,067,308 in 1905, this therefore, amounted to a per capita expenditure of $1.83. During the same period there was expended in the United States at large $227,482,123, for a population of about 82,574,195, or $2.75 per capita. If this test is applied to the total appropriations for the period 1802–1906, inclusive, the expenditures for New York and the United States, respectively, are $4.52 and $6.28 per capita of the population in 1905.

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When compared with the appropriations for other States, the meagerness of New York's allotments is strikingly apparent. In making these comparisons, it must be remembered, moreover, that many of these States have no important waterways within or adjoining their borders and that others, as for example those contiguous to the Mississippi river—the appropriations for which are now beyond the $100,000,000 mark — derive a benefit from immense expenditures, while the accounts for these expenditures are entered in a general fund and not distributed among the several States participating directly in the benefits which accrue. Nevertheless it is significant that where, according to the Chief of Engineers' reports, the State of New York, between 1802 and 1900, enjoyed aid from the Government in the improvement of its harbors and rivers to the extent of $3.92 per capita of its population at the latter date, and Vermont (a State whose interests are perhaps no less subserved by the proposed legislation than those of New York) to the extent of only $2.28; yet western States, which have been virtually settled only during the last half of that period, have secured appropriations from the Federal funds amounting in 1900, on the basis of the same census (1900), to very considerable sums, as for instance Oregon and California, with per capita expenditures of $6.73 and $6.19, respectively. As compared with $3.92 per capita for the Empire State (the only State with both a lake and ocean frontage to consume the appropriation), others throughout the country have fared notably well; Wisconsin has had $5.32, Maine $7.28, Florida $8.76, Texas $5.07, Michigan $10.18, Rhode Island $8.24, Maryland $4.33, South Carolina $5.34 and West Virginia $5.18 per capita.

When we study the statistics of traffic, we observe from a different point of view the paucity of the appropriations to New York, and we see the relatively great magnitude of the traffic on the waterways of the State, and the relatively small allotments which these waterways have received. No Federal aid has been extended to us in the construction or maintenance of our great canal system, which even at this low tide of its career carried a tonnage in 1906 exceeded only by the amounts on the Monongahela and the Mississippi rivers. The Hudson, moreover, leads all the rivers of the country, having a traffic of but little less than twenty million tons yearly, almost twice that on any other river. It should be observed also that the traffic of the Monongahela is 85 per cent coal floated down stream and that this traffic is largely

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repeated in the estimates for the Ohio river. Upon these two rivers and for this traffic, together with that of the Louisville and Portland canal and Falls of the Ohio, all practically Ohio river improvements, the Federal Government has generously expended some thirty million dollars. Shall it be said that the "Two-Thousand-Ton Barge Canal" of the Empire State, to be built and maintained by its people as a great free waterway to the commerce of the United States, bearing its share of our gigantic through grain traffic from the West to the East and the still more gigantic grain traffic of the New Northwest, is entitled to less consideration?

It is also significant that in the great continuous chain of waterways which reach from the Atlantic coast through the land to the western extremity of Lake Superior, that portion across New York State from the Hudson to Lake Erie is the only link for which the Federal Government has not expended its millions, and it is moreover — even for the freight which comes all or in part by rail — the key to all the rest of the route, or in the language of the *Twelfth Census,* the key to the "greatest internal waterway in the world, having a ton mileage equal to nearly 40 per cent of that of the entire railroad system of the United States."

It appears, in short, that the 10 per cent of the population of the United States composing the State of New York is charged with the expense of accommodating 50 per cent of the foreign trade, the receipts for which it turns over to the general Government, and that in return it is assisted by that Government to the extent of just about 7 per cent of the total moneys appropriated for harbor and river improvement for the utilization of the commerce of the realm.

Again, if the Federal Government is, like Providence, disposed to help those who help themselves, it will find no State or section of the land more deserving than New York. She has always felt that the through routes of communication she provided to the interior merited some share of national consideration, and the Government at Washington has committed itself to that view in late years by expending no less than $450,000 (besides earlier appropriations) for the examination of a ship canal route across that state from the Great Lakes to the seaboard. Nevertheless, upon being refused, New York has again and again bent herself heroically to the task, alone and unaided. She has spent the sum of approximately $213,000,000 upon her canal system, amounting

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to $26.40 per capita of her present population (1905 census), the greater part of this sum, however, having been expended when her population was not more than half its present size. She has undertaken actively the expenditure of $101,000,000 more, making a total appropriation to date equivalent to $38.92 per capita. For the work of canalizing the Hudson from Troy to Waterford she requests of the Government aid to the extent of about 14 cents per capita of her population, or one and one-third cents per capita of the population of the whole country.

This appeal of the State of New York seems the more moderate when it is considered that the neighboring Dominion of Canada has expended no less than $100,000,000 upon her canal system, amounting to $18.62 per capita on the basis of a population of 5,371,315, and that there are under way projects involving the expenditure of a second $100,000,000, making to date practically an assured expenditure of $37.24 per capita, and this without considering the numerous appropriations for river and harbor improvement in the Dominion. That New York should be called upon to contest almost single-handed a large proportion of these extensive outlays made for the immediate and avowed purpose of diverting the traffic of the interior from American to Canadian channels is — whether just or unjust — the accepted situation. That the Federal Government should not begrudge the small contribution asked of it would seem to be patent.

Not only Canada but all of Europe has in late years, and with remarkable unanimity, awakened to the demands and benefits of water transportation for the interior. In England and in Germany, and in Belgium and the Netherlands, in Russia and in Austria, great sums have been spent in the extension and improvement of navigable waterways and harbors connecting. In the single instance of France, with a population of 39,118,995, fully $800,000,000 has been expended in the improvement of rivers and harbors, an amount of $20.45 per capita, and by one act of December, 1903, nearly $40,700,000 was appropriated for a series of important works for the betterment of inland navigation.

Thus it appears that the United States Government, which from the beginning has expended upon New York only about $4.52 per capita of that State's population, has fallen as far short of a noble emulation of foreign and neighboring countries as has New York State herself — though stripped of the direct revenue of her commerce — exceeded these nations in the amounts of her appropria-

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tions, in her devotion to the principle of internal navigation, and thereby in her gratuitous service to the vast interior of the land.

Moreover, northward from the stretch which it is proposed to improve extends the line of the new trunk canal to Lake Champlain, now in process of construction. Through Lake Champlain, and between the states of New York and Vermont, navigation is unimpeded. From the north end of that body of water the Richelieu river flows northward through Canadian territory into the St. Lawrence at a point some forty-six miles below Montreal. This river is rendered navigable to boats of about five or six feet draught by means of the Chambly canal and St. Ours lock, but as far north as the town of St. Johns it is suitable, with very slight expenditure, for a 12-foot draught. From St. Johns there has been long and seriously proposed a cross-cut by a route which has been examined twice by the United States Government and declared entirely feasible for the location of a ship or barge canal. In less than forty miles of alignment this proposed cross-cut, which has been known as the Caughnawaga canal, would connect the Richelieu river with the St. Lawrence at a point somewhat upstream from Montreal. Its construction has been ardently advocated in Canada as well as in connection with our waterways, and at least one company has been formed and chartered to undertake the work. If this link should be built, there would exist a great international waterway, threading its course almost in an air line between the metropolis of the United States and that of the Dominion of Canada, of which the slight additional stretch of the Hudson river, that the United States Government is asked to improve and maintain as its share, is an integral and important part.

The traffic advantages accruing to the United States from this quickened, international intercourse may be predicted, when it is remembered that the cargo at Montreal must needs choose between two routes to the open ocean; one 1,000 miles long to the Straits of Belle Isle through treacherous, ice-bound channels, where the insurance rates are exorbitant, and the other over the safe channels of Lake Champlain, the Hudson and the canals, a distance of only 400 miles to the splendid harbor of New York.

But aside from the international signficance of this waterway it has had a distinct national or interstate character from the time when the great plot of the Revolution hinged on dividing the colonies by military invasions along this strategic route. The

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early promoters of the Champlain canal saw that there was a considerable land-locked section of Vermont and northern New York which lay more or less stagnant because of the inferior outlet for its products. An examination of the detailed statements for this canal over a series of years will demonstrate to what extent the canal has transported the products of Vermont and Canada, as well as of northern New York, and will in some measure illustrate its services towards opening up the marble quarries of Vermont and stimulating the "celebrated Champlain iron district." And since the bulk of the traffic through the Chambly canal consists of the Ottawa lumber trade southward, which, on account of poor facilities of late years has passed largely to the railroads, it is apparent that the new waterway, in which the Government is asked to interest itself, will benefit to a very large extent the outlying country — New England, and particularly the Vermont district.

The project affords an opportunity for the Federal Government to extend its aid to an inland section, cut off of necessity from participation in many of the privileges of the coast and the appropriations therefor. The State of Vermont has had a very meagre allotment from the river and harbor expenditures of the nation. This is the only state north of Mason and Dixon's line and east of the Mississippi river which has no frontage on either the Great Lakes or the ocean, and therefore is entirely dependent on an artificial outlet. As an interstate waterway, the general Government can therefore afford to recognize the great northern canal, and to lend a helping hand.

In further support of the proposition that the waterway up the Hudson river and across to Lake Champlain is by no means exclusively of interest to the port and state of New York, the rapid and steady growth of the trade of Montreal should be considered. When we study the statistics of the total export trade of the five great Atlantic ports — New York, Boston, Baltimore, Philadelphia and Montreal — the fact that the Canadian metropolis has doubled its proportion in the last twenty or twenty-five years and that this growth has continued uninterruptedly throughout the decline which the four ports of the United States have generally experienced during the last half decade, serves to warn us that Montreal, as a rising competitor, is more than a mere illusion. Evidently the country has somewhere been negligent in its efforts to hold the export trade from the interior. Apparently, too, the Canadian government is actively reaping the benefits of its liberal canal policy, and it behooves the United States to recognize these facts in a substantial way.

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In conclusion the memorial quotes some very pertinent extracts from the speeches of Congressmen themselves in their discussion of the river and harbor bill in the House of Representatives. Among them is the declaration by Mr. Lawrence, of Massachusetts, of the well-attested fact that "the influence of the Erie canal as a regulator of freight rates has been felt over the entire country." Also the statement of Mr. Burgess, of Texas, who said: "There not being an adequate supply of revenues to meet all the needs completely those who can and will contribute themselves to the hastening of the consummation of their local project certainly can justly expect some contribution from the Government itself."

State Conference on Waterways of New York.

On May 7, 1908, there was held in Albany, under the auspices of its Chamber of Commerce, an important State conference for the consideration of the waterways of New York. Representatives from the commercial bodies of several cities throughout the State were in attendance, and much interest was shown in the twelve papers presented by well-known authorities on their respective subjects.

The State of New York stands alone among the commonwealths interested in waterway improvements in not having an efficient waterways association, and it is hoped that this conference will mark the beginning of concerted action throughout the state toward securing desired betterments and that it will start a movement to awaken a popular realization of the importance and need of improved facilities for transportation.

The papers read at the conference dealt chiefly with New York's waterways, but there were two on "Our Nation's Waterways," by members of the House of Representatives. In the following pages the greater part of one of these is printed — the address by Hon. James H. Davidson, of Oshkosh, Wis., Chairman of the House Committee on Railroads and Canals, Member of the Rivers and Harbors Committee and Director of the National Rivers and Harbors Congress. In some future issue of the *Barge Canal Bulletin* we may give synopses of the papers on New York waterways, but Mr. Davidson described so well the broader phase of the accomplishments and needs in the whole country, as well as in our own State, that his remarks become instructive and interesting to all concerned about waterway improvement. The title and text of Mr. Davidson's paper follow: —

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Our Nation's Waterways — Their Present Condition.

The improvement of our national waterways is a national duty — a duty not to be delegated, but one, I fear, too long neglected by the General Government. Our coast harbors and our inland rivers, suitably improved, are capable of conferring great benefits on the citizenship of our country. In our great struggle for commercial supremacy, the transportation of our products is a vital question. We are producing more than we are consuming. The surplus must find a market abroad. The value of many of our products is determined by the price received for the surplus.

Our seacoast harbors must accommodate the largest ships, to the end that ocean transportation may be had at the lowest possible cost. A few years ago the average depth of 14 of our most important seacoast harbors was 12.4 feet. They accommodated ships of 1,500 tons to 2,000 tons. These harbors have been deepened by the General Government to an average depth of 25 feet, and some of them to a depth of 35 feet. What is the result? The 2,000-ton ship gave way to the 5,000-ton ship, and that in turn is now giving way to the 10,000-ton ship.

It may be interesting to note that during the time the Government has been improving these harbors, the rates for transportation have steadily decreased. In 1873 the average rate for carrying a bushel of grain from New York to Liverpool was 21 cents. During the last five years the average rate has been 2.87 cents per bushel. Notes the change in freight rates by decades. In 1870, with 22 feet draught, the rate was 21 cents per bushel; 1880, 23 feet draught, 16 cents; 1890, 30 feet draught, 10 cents; 1900, 35 feet draught, 5 cents. From these figures it will appear that the improvement of our seacoast harbors is a commercial necessity, lessening the cost of transportation not alone to the immediate section where the improvement is made, but to the producing sections of the country, even though they be far in the interior.

The expenditures made on the interior waterways of the country have resulted in equal benefits to the people of all sections of the country. On the Great Lakes the average original depth of 37 harbors was 4.1 feet. Now it is 17.8 feet, and many have a depth of 21 feet. The expenditure made by the General Government on these harbors and the connecting channels amounts to about $70,000,000. Now note the effect of this improvement on the freight rates of that section. In 1870 the cost of transporting a bushel of

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wheat from Chicago to New York by the lakes and the Erie canal was 17.11 cents. In 1880 it was 12.27 cents. In 1890 it was 5.85 cents. In 1900 it was 4.42 cents. This competing waterway had its effect on the rail rate, and instead of a cost of 46.1 cents to carry a bushel of grain from Chicago to New York by rail, it is now but 10.6 cents — a reduction of practically three-quarters.

Do you know what this means to the section of the country in which I live? The five States immediately adjacent to Lakes Superior and Michigan produce about 3,000,000,000 bushels of grain per annum. The reduction in freight rates means a gain to the producers of that crop annually of not less than $20,000,000. The price of the grain crop of the country is not fixed on the farm, but it is fixed at Liverpool — the great market centre of the world — and the price to the producer is the Liverpool price, less the cost of transportation.

Again, every time you cheapen the cost of transporting a ton of coal, you benefit the consumer of that coal, who may reside many miles in the interior, because, unlike wheat, the cost of the coal to the consumer is the price at the mine with the cost of transportation added. Hence every reduction in the cost of transportation benefits the consumer.

The waterway is the cheapest mode of transportation known to commerce. The average rail rate in the United States is 7.6 mills per ton per mile. Compare this with the rate on our waterways. The average rate on the Great Lakes is 0.85 of one mill per ton per mile; on the Ohio river 0.76 of one mill per ton per mile, and on the Mississippi river 0.67 of one mill per ton per mile. Let me give you a striking illustration of the difference in these two rates. Iron ore is carried from Superior to Ashtabula on Lake Erie, a distance of nearly 1,000 miles, at 82 cents per ton. Coal is carried from Lake Erie ports to Chicago and Duluth for 35 cents per ton. This over a waterway improved by the General Government. There is carried annually over the divide between the Pittsburg district and Lake Erie ports, a distance of 135 miles, 50,000,000 tons of commerce. This consists largely of coal, coke and iron ore, the average rate for which is 90 cents per ton — 90 cents per ton for a distance of 135 miles, as against 35 cents for coal and 82 cents for ore on the Great Lakes, a distance of 1,000 miles.

Aside from the great benefits derived from the cheap transportation of the commodities just referred to, it may be interesting for

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you to know that the total commerce passing through the Detroit river during the open season of navigation last year amounted to 59,000,000 tons, the transportation charge of which amounted to about $35,000,000. As the average water rate is only about one-seventh of the average rail rate of the United States, it will appear that there was saved in freight charges alone on the commerce passing over that waterway during the last year the sum of $210,000,000. I respectfully submit that this is a fair return on the expenditure of $70,000,000, made by the National Government.

Let me give you another illustration. We have spent on the harbor at Galveston about $9,000,000. The statistician of the Interstate Commerce Commission reports that there is saved annually on the farm products of the six States tributary to that port the sum of $6,000,000.

These figures demonstrate beyond question the decided advantage a suitably improved waterway affords for the transportation of the products of the country. They demonstrate beyond question the fact that money from the public treasury expended in the improvement of waterways is an investment which returns many-fold to the people of the country.

Notwithstanding this showing, the policy of our Government toward its waterways has not been a liberal one. We have expended up to the present time about $500,000,000. Compare this with the expenditures of other countries. Holland has 2,000 miles of waterways, and has expended thereon $1,500,000,000. France, with its 4,000 miles of canals and canalized rivers, has spent considerably over $1,000,000,000. Austria, since 1848, has spent $150,000,000 in the improvement of her waterways. Germany, during the decade preceding 1904, increased her artificial waterways by nearly 1,000 miles, giving her a total of 10,000 miles at a cost of over $2,000,000,000, and making it possible to transport the commerce of the productive interior to the seacoast harbors at the lowest possible cost. France has so far developed her waterways that it is possible in that country to transport commerce from any one city to any other city in the republic without breaking bulk. The Manchester canal cost $80,000,000; the Kiel canal cost $40,000,000; the Suez canal cost $20,000,000, and there has been expended upon the Clyde river $70,000,000.

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When we compare the expenditures of $8,000,000 and $9,000,000 on such harbors as Boston and New York, the amount seems small indeed as compared with $75,000,000 spent at Hamburg, $27,000,000 at New Castle, $24,000,000 at Marseilles, and $200,000,000 at Liverpool. The construction of the Manchester canal has made the city of Manchester the second port of Great Britain; the improvement of the Clyde river has made Glasgow one of the greatest commercial ports of the world, and the improvements of the waterways of Germany have increased the commerce of that country during the last 25 years 265 per cent.

In our country the average annual appropriation for the last 20 years has been about $14,000,000; the average for the last ten years, about $20,000,000. This money has been expended in various sections of the country. I have called your attention to the improvement made in the coast and lake harbors. The Hudson river has been given 11 feet of water at a cost of $5,000,000; the Delaware river, a depth of 26 feet, at a cost of $4,500,000; the James river, a depth of 16½ feet, at a cost of $2,000,000; the St. John's river, a depth of 14 feet, at a cost of $1,800,000; the Alabama river, a depth of 23 feet, $4,700,000; Buffalo bayou, a depth of 25 feet, $4,000,000; the Cumberland river, a depth of 6 feet, $2,500,000; the Tennessee river, a depth of 6 feet, $5,000,000; the Ohio river, a depth of 6 feet, $6,000,000; the Mississippi, varying depts, $20,000,000; the Columbia river, a depth of 7 feet, $8,000,000. Many of these projects are not yet completed; some of them have been under way for many years. Some of the projects in the vicinity of the city of New York have been receiving small expenditures for the last 15 years and are yet far from completion. The six-foot project for the Ohio river was adopted over 20 years ago and at the rate appropriations have been made it will take at least another ten years to complete it. The fault, however, has not been with the Rivers and Harbors Committee of Congress. The fault has been with the country generally — in not appreciating the benefits to be derived from the improvement of waterways — and with the all too frequent reference to steals, pork barrels and similar expressions.

The Committee on Rivers and Harbors that reported the last appropriation bill, sat in session for over 60 days. It had before it projects having the favorable indorsement of the Engineers and of the Secretary of War, which, if adopted, would call for an expenditure of $500,000,000, and although the Com-

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mittee reported the largest bill ever enacted, carrying something like $86,000,000, it was but a mere drop in the bucket, compared with the demands coming from all sections of the country.

The trouble has been that the river and harbor appropriations have not been given the standing which their importance and character deserve. Regular appropriation bills for the maintenance and extension of the army, of the navy, of the other branches of the government, are reported annually; and in these piping times of peace, when there is absolutely no war-cloud in sight and where there is not the slightest excuse for martial preparation, a demand is made upon the Congress of the United States to appropriate 75 per cent of its revenue for its defense. I submit that this is not a square deal thus to expend the public money, giving but a paltry 3 per cent to the commerce of the country.

If the people of the country will be as earnest in their demand for larger appropriations for the waterways of the country, as some have been in their demand for increased appropriations for the defense of the country, this work of improving our waterways can go forward with greater rapidity and the benefits to be derived therefrom secured at an early date.

We know that there has been a tremendous congestion of the commerce of the country. The railroads were utterly unable to transport it. While during the last decade the commerce of the country increased 126 per cent, the transportation facilities increased only about 22 per cent. At present, owing to causes unnecessary at this time to discuss, there is a lessened commerce and undoubtedly a number of freight cars are idle on the sidings, yet this is but temporary and it is our duty, as citizens of the country, bound to enjoy in the almost immediate future a return of the prosperity which so generously blessed us during the last ten years, to prepare for that future.

I desire to express my admiration for the manner in which the great Empire State has, out of its own treasury and without asking aid or consent of anybody, undertaken the improvement of its own waterways on a most generous plan. Your work for the improvement of the Erie canal commands the admiration of the entire country. As the old Erie canal marked the beginning of waterway improvement in this country, so will the new Erie canal stand as a monument to that system of internal improvements so ably and persistently advocated by that far-seeing statesman — De Witt Clinton.

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Barge Canal Bulletin

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THE STATE ENGINEER AND SURVEYOR

OF THE

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FREDERICK SKENE, State Engineer and Surveyor

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Anent the Deepening of the Hudson River.

It is perhaps unnecessary to say, by way of premise, that the actual channel of the Barge Canal will not extend beyond the point of its debouchure at Waterford, using the channel of the river from that place to the eastern terminus at Troy, and that the bulk of its east-bound traffic will eventually reach the wharves of Greater New York. It has been the hope and expectation of its friends that the Federal Government, in the exercise of its paramount and constitutional control over commerce and navigation, will deepen the upper reaches of the Hudson, at least to the depth required by the commerce of the Barge Canal. Three centuries ago the boatswain of the *Half Moon* reported navigation impossible above its anchorage at Albany. When the projected improvements of the Hudson river are completed, it is to be hoped that this will not again occur.

From time to time concerted effort has been made in this direction, resulting in the formation of several associations having this common purpose in view. So much confusion has arisen in the press accounts of their proceedings from the similarity of names, that it is perhaps a matter of timely interest to briefly advert to their origin and organization, that readers of the *Bulletin* may more easily follow the future progress of this movement.

Nearly all the states in the Union, except the Empire state, have at the present day state waterway associations, each formed for the purpose of promoting the special waterway improvement projects located within its boundaries. There are also a number of organizations more or less local in character, formed for the purpose of forwarding local schemes. Other powerful organizations are in existence, among them the Ohio River Improvement Association and the Mississippi River Improvement Association, otherwise known as the Lakes-to-the-Gulf Association, the purpose of each being obvious from its name. In the East we have the Atlantic Deep Waterways Association, formed for the purpose of promoting an inland channel along the Atlantic coast of the United States. Its original limits were from Cape Cod to Beaufort, S. C., but later the limits have been extended to the state of Florida, and without doubt the ultimate project will include a channel across that state to the Gulf of Mexico.

This Association has held two annual meetings, or conventions. The first was in Philadelphia, for the purpose of organization.

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This year's meeting has just occurred in the city of Baltimore. At the first convention the delegates present were given an object lesson as to the benefits of deeper waterways, being taken from Philadelphia to Trenton, N. J. by steamer, in order to see the conditions of the upper Delaware river after the bars had been removed. This year also, the delegates were given a trip — from Philadelphia to Baltimore through the Delaware and Chesapeake canal, this being one of the connecting links in the proposed Atlantic coast waterway project and intended to be the first, or one of the first links put under construction. The delegates were also given a ride to Annapolis and further made an investigation of Baltimore harbor.

The Hudson river project has been represented on the program at both of these conventions. Last year Wm. B. Jones, Sec. of the Albany Chamber of Commerce and a delegate, read a paper entitled, "The Hudson River Outlet from the Erie Canal to the Sea." This is the special project of New York state. This year, after considerable hard work, the convention was persuaded to include the Hudson river project in the resolutions, as follows: "That the Hudson river be deepened so as to meet in its upper reaches the needs of the traffic upon the improved Erie canal."

Another convention, which recently has occupied the attention of the public press, is that of the National Rivers and Harbors Congress, held at Washington, D. C. This, as its name implies, is national in its scope. It advocates a policy, not a project. At the session of this congress which has just been held, New York state was well represented on its program. Hon. Seth Low, of New York, made an important address, in which he broadly claimed that the commercial supremacy of New York city as a port was due to the building of the Erie canal. (One needs but to consult the pages of the official history of the canals of New York to find this statement amply verified.— Ed.) Another address was given by Calvin Tompkins, a member of the New York Board of Trade and Transportation, and a third was by Hon. Frederick Skene, State Engineer and Surveyor of New York, its subject being, "The New York State Barge Canal, its Purposes and Scope." A fourth address emanated from our genial senator, Hon. Chauncey M. Depew.

In its permanent organization, as at present constituted, Wm. B. Jones is the vice-president representing the state of New York

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on the board of its directors. This state is also represented by Olin J. Stephens of New York, Edward H. Butler of Buffalo and Robert A. Downey of Oswego.

During the session two conferences of the New York state delegates were held. As a result, a committee was appointed to draw up resolutions concerning the necessity of improvements to the waterways of New York state, to be presented to each of the New York state Congressmen. The committee was further empowered to consider the advisability of forming a New York State Waterway Association, as suggested at the beginning of this article. Of this committee Senator Henry W. Hill, of Buffalo, is chairman.

The result of the congress at Washington, of which we have spoken, was the adoption of a resolution in substance urging the appropriation of $500,000,000 by Congress for waterways, and the issuing of Government bonds at such times and in such amount as Congress shall deem necessary to meet the requirements, somewhat upon the plan of the present Panama canal bonds. Among those who addressed the Congress, both for and against the project, was Speaker Cannon of the House of Representatives. He was in favor of specific appropriations for specific projects, as heretofore, under the scrutiny of Chairman Burton, of the House Committee on Rivers and Harbors. He also stated that he was opposed to the blanket appropriation under consideration, comparing it to a Mother Hubbard dress, which "covered everything and touched nothing."

The New York state committee above referred to, of which Senator Henry W. Hill is chairman, will hold a meeting early in January to consider further action. While New York has placed itself on record, at the recent congress, as in favor of the general resolution, Senator Hill's committee will lose no time in furthering the specific project of this state — the improvement of the channel of the Hudson river. It is felt that New York state can not afford to wait for the slow action of a general appropriation. As we go to press it seems by no means certain that such an appropriation or even that a river and harbor bill will pass at the coming session of Congress. However, it is sincerely hoped that some relief will be speedily afforded.

It is fairly well known that in the Federal operations for improvement of the upper Hudson river channel during the last five years, calculations have been based upon a channel twelve feet

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deep by 300 feet wide. The assertion is made that we are to have such a channel at *mean* low water, but the objection has been made that at the height of the navigable season, when the river boats are loaded with their heaviest freights, the mean low water phase is non-existent and we actually have extreme low water, which is practically two feet lower than the mean low water standard. This gives us but a 10-foot channel which, at two points at least, is not more than 50 feet wide. Here steamers of size dare not meet or pass except at risk of accident.

The Albany Chamber of Commerce has been for several years urging a deeper channel for the Hudson. Within a year or so, in order to realize the benefit of added strength from those interested, correspondence has been had with the officials of various places along the Hudson river. This has resulted in the organization of the Hudson River Improvement Association, which advocates a 22-foot channel in the Hudson connecting with the terminus of the Barge canal at Waterford. This association is fully organized, with a constitution, was represented at the congress spoken of, and, if we are not mistaken, will take further action during the coming season. And with the above explanatory statement of the present status of this somewhat complicated movement, we rest.

Encouraging.

On contracts Nos. 40, 41, 46, 47 and 68, bids were opened November 17 and 18, as stated in the last issue of the *Bulletin,* when the number of bids, the lowest bidder's name and the amount on each were given. The several bids in detail are given elsewhere in this number. There is cause for congratulation here. The liberal number of bidders, forty-four in all, on these five contracts, suggests that an active spirit of competition is abroad, quite in contrast with some similar occasions, not so far back in point of time. Of the forty-four tenders made, all except six were below the engineer's estimates. Both facts, whether attributable to this source or not, answer admirably as an argument to show that prosperity, or at least that confidence which is its sure forerunner, has indeed returned.

Again, and along these same lines, it may be well to note that within the period referred to, it has been deemed essential to utilize the permissive clauses of the law of 1903 and award contracts at a slight advance beyond the estimates. It is pleasing to ob-

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serve that in the present instance this necessity has not arisen. The total of the estimates on these five contracts was $6,877,287 and the total of the awards was $5,941,422. This means a saving of well towards another million dollars, or to be more exact, $935,-865, which is 13.6 per cent of the engineer's estimates.

Progress of Contract Work.

The table following shows the value of work done on each contract during November, the total to December 1, and the relative proportion which the value of work done bears to the value of the whole contract.

The figures show a net diminution of work accomplished during November from that of the month before, of $208,050. No apology, however, is deemed necessary for this showing. The approach of winter in a climate like that of New York state necessarily means a partial cessation of field construction in many ways. And in preparation for this season some of the larger and more advanced contracts, especially those in river lines, which have pushed their operations to the limit during the season past, have wisely planned their season's work and, having accomplished it, are putting things in shape to meet the dangers of coming ice and floods, with a minimum of risk.

Three-quarters of this diminution, or $153,790, has occurred on the Champlain line, where the rigor of the winter begins earlier, lasts longer and will be most severely felt.

In concrete, while the weather of November has not actually interfered with its laying to any great extent, yet in pursuance of the plans suggested old jobs have been completed and new ones have not been started.

More than half, or $110,750 of the diminution, has occurred on the two contracts, Nos. 15 and 25, where the great hydraulic dredges, which have coined wealth by the yard throughout the season for their owners, have been engaged in comparatively unproductive movements or operations.

In the Mohawk river contracts, certain sections of the great masonry dams have been placed in condition to withstand the floods and construction of the coffer-dams for other remaining sections is wisely deferred for the present.

Meantime the bridge companies, whose work in a measure lies above such risks, have been busily engaged in erecting several structures, where foundations have been earlier built.

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Contract No.	CONTRACTOR.	Total Value of Work.			Percentage of work done to December 1, 1908.
		Put under contract.	Done to December 1, 1908.	Done during November, 1908.	
1	Empire Engineering Corporation..	*$607,421	$449,310	$690	74.0
2	The Ferguson Contracting Company.....	*906,896	694,390	24,150	76.7
3	Sundstrom & Stratton.....	*657,273	578,270	3,670	88.0
4	Empire Engineering Corporation..	*729,568	441,900	15,990	60.5
5	Empire Engineering Corporation..	*375,872	125,820	0	33.5
6	Frank A. Maselli.....	*1,024,257	696,830	16,860	68.0
7	Groton Bridge Company.....	*101,930	72,400	7,520	71.0
8	Pittsburg-Eastern Company.....	*1,505,362	441,970	46,080	29.3
9	Thomas Crimmins Contracting Company.....	*736,855	111,310	24,310	15.1
10	Mosier & Summers.....	*1,103,023	223,580	13,980	20.3
11	Fort Orange Construction Company.....	*1,354,864	524,360	47,110	38.7
12	Stewart-Kerbaugh-Shanley Co...	*3,391,834	446,130	92,060	13.2
13	Penn Bridge Company.....	23,674	0	0	0
14	Acme Engineering & Contracting Company.....	*2,947,838	689,470	123,620	23.4
15	Atlantic, Gulf & Pacific Company.	*1,523,820	804,530	17,970	52.7
16	United Construction Company....	*69,077	2,650	2,650	3.8
17	The Scofield Company.....	*836,782	57,560	0	6.9
17	Alexander Murdoch.....	*†(806,455)	236,250	48,050	29.3
18	O'Brien & Hoolihan Contracting Company.....	*855,002	321,970	17,410	37.7
19	Great Lakes Construction Company.....	*891,401	159,270	11,630	17.9
25	Atlantic, Gulf & Pacific Company.	*1,717,649	520,070	40,000	30.3
26	Lake Erie Dredging Company....	59,795	9,640	2,170	16.1
27	Kinser Construction Company....	*968,295	362,700	47,420	37.4
31	Casey & Murray.....	829,770	10,230	3,160	1.2
34	M. Fitzgerald.....	*22,449	22,303	0	Finished.
35	Gilmour-Horton-Allen Company..	*745,968	77,520	16,330	10.4
40	United Engineering & Contracting Company.....	2,166,298	0	0	0
41	Butler Bros., Hoff Company.....	281,330	0	0	0
45	Scott Bros.....	467,514	117,140	39,790	25.1
46	Kinser Construction Company....	1,212,833	0	0	0
47	The Crowell & Sherman Company	1,262,638	0	0	0
55	Arthur McMullen.....	905,347	0	0	0
60	Empire Engineering Corporation..	1,349,084	64,300	36,340	4.7
61	E. M. Graves.....	1,047,994	490	490	0.04
64	Empire Engineering Corporation..	1,290,492	15,810	11,420	1.2
66	Empire Engineering Corporation..	750,685	2,480	2,480	0.3
68	Shanley-Morrissey Inc.....	1,018,323	0	0	0
	Totals.....	$35,739,213	$8,280,653	$713,350	.....

* Includes all alterations in force to date.
† Relet,— not included in total.

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Total Amount of All Kinds of Construction Work, to December 1, 1908.

Similar kinds of work are grouped under one heading; an enumeration of the items grouped is shown in the foot-notes.

Contract Number.	Excavation.a	Embankment.b	Concrete.c	Dry stone work.d	Sawed lumber.e	Round timber.	Piles.	Iron and steel.f	Iron and steel.g	Miscellaneous items of work.h	Miscellaneous construction items.i	Extra and unspecified work.j	Extra and unspecified work.k
	Cu. yds.	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*	*Ft. B. M.*	*Lin. ft.*	*Number.*	*Lbs.*					
1.....	678,851	24,657	4,608	10,477	24,174	38,857	0	308	0	$288	0	0	0
2.....	426,125	58,420	82,910	0	26,440	0	1,488	375,792	$1,626	28,156	$3,368	$1,713	$28,569
3.....	790,147	103,796	34,274	4,610	54,716	0	16	182,571	0	6,338	1,181	17,587	37,076
4.....	1,769,772	60,835	2,976	29,746	921,144	476,559	2,629	158,870	495	27,852	148	0	1,257
5.....	901,601	10,649	1,770	518	56,457	0	36	0	0	2,862	153	0	0
6.....	1,476,703	28,899	1,701	0	0	0	0	0	0	560	920	0	0
7.....	0	0	111	10	81,491	0	0	1,342,431	0	0	4,590	50	0
8.....	180,760	18,291	34,129	1,746	129,460	0	10,014	130,486	7,952	660	2,340	0	0
9.....	171,644	66,211	982	0	10,005	0	135	20,560	0	1,440	5,518	0	0
10.....	198,766	11,301	5,457	3,851	57,500	0	0	26,627	1,700	0	3,518	1,198	0
11.....	440,166	115,892	53,431	2,243	221,280	0	333	224,215	0	1,336	4,972	0	0
12.....	1,052,899	13,682	1,493	179	41,870	0	121	571,360	0	2,930	1,305	1,100	0
13.....	0	0	0	0	0	0	0	0	0	0	0	0	0
14.....	237,969	34,141	65,094	2,819	95,880	0	150	103,361	811	45	425	2,506	0
15.....	2,152,789	1,736	27,054	248	114,280	0	3,250	184,299	2,034	300	27	5,500	0
16.....	0	0	0	0	0	0	0	59,566	0	0	0	0	0
17.....	85,066	4,919	25,115	7,025	99,941	0	1,667	101,302	2,031	200	573	0	0
18.....	299,199	162,757	22,669	458	22,800	0	136	56,141	1,272	900	675	14,456	0
19.....	572,919	0	216	0	221,982	0	46	3,786	0	0	0	300	0
25.....	2,201,572	20,542	1,203	143	27,935	0	389	11,040	0	1,022	0	0	0
26.....	27,714	0	0	0	0	0	0	0	0	10	0	0	0
27.....	864,225	36,514	18,682	0	84,819	0	399	81,569	0	1,189	125	7,174	7,669
31.....	6,961	0	0	190	0	0	0	0	0	1,250	0	0	0
34.....	0	0	195	3	0	0	0	378,667	0	0	3,890	0	0
35.....	21,000	0	5,174	0	0	0	0	271,846	866	0	1,727	0	0
40.....	0	0	0	0	0	0	0	0	0	0	0	0	0
41.....	0	0	0	0	0	0	0	0	0	0	0	0	0
45.....	106,396	85	9,496	377	16,247	0	188	4,417	381	5,642	200	0	0
46.....	0	0	0	0	0	0	0	0	0	0	0	0	0
47.....	0	0	0	0	0	0	0	0	0	0	0	0	0
55.....	0	0	0	0	0	0	0	0	0	0	0	0	0
60.....	84,472	25,980	1,273	4	6,336	0	136	8,966	0	1,534	832	0	0
61.....	1,343	186	0	0	0	0	0	0	0	0	0	0	0
64.....	17,989	9,622	245	0	0	0	0	327	0	2,210	0	0	0
66.....	1,466	426	190	0	0	0	0	0	0	0	0	0	0
Totals...	14,768,514	809,541	400,448	64,647	2,314,757	515,416	21,133	4,298,527	$19,169	$86,724	$36,487	$51,584	$74,571

a Includes earth and rock excavation and grubbing. *b* Includes embankment and puddle. *c* Includes concrete (all classes) and grouted filling. *d* Includes ballast, dry retaining wall, wash-wall, lining, riprap and stone filling in cribs. *e* Includes sawed lumber (all kinds), wooden sheet-piling and sheeting and bracing. *f* Includes chains, iron castings (plain or machined), iron pipe and specials, metal reinforcement, steel and iron fastenings, steel castings, structural steel and wrought iron. *g* Includes items usually paid for by the piece — fender fastenings, gate-hoists, lock-gates, needle-dams, valves, valve-seats and valve-supports. *h* Includes bailing and draining, clearing, extra labor on forms and finishing concrete, removing concrete, dressing concrete, maintaining traffic, overhaul and removing revetment. *i* Includes channeling, cut stone work, iron railings, paving (all kinds), removing existing structures, raising bridge superstructures, repairs to local sewers, etc., sidewalks and curbs, steel sheet-piling, trenching and backfilling, vitrified pipe and wooden fencing. *j* At contract prices. *k* At cost, plus a fixed percentage.

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ITEM.	Measure.	Quantity.	Engineer's Estimate.		Buffalo Dredging Co., 306 D. S. Morgan Bldg., Buffalo, N. Y.		Mason & Hanger Co., and Millard & Lupton Co., Room 1768, 50 Church St., N. Y. City.		MacArthur Bros. Co., 11 Pine St., New York City.		United Engineering & Contracting Co., 32 East 33d St., New York City.		American Pipe Mfg. Co., 11 N. Broad St., Philadelphia, Pa.	
			Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount	Price.	Amount.	Price.	Amount.
Coffer-dams, pumping, etc.	lump sum	.....	$10,000 00	$10,000 00	$10,000 00	$10,000 00	$10,000 00	$10,000 00	$10,000 00	$10,000 00	$10,000 00	$10,000 00	$10,000 00	$10,000 00
Clearing	"	.....	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00	1,600 00	1,600 00
Grubbing	cu. yds	100	30	30 00	30	30 00	30	30 00	33	33 00	30	30 00	24	24 00
Excavation	"	2,336,300	93	2,172,759 00	83	1,939,129 00	83	1,939,129 00	77	1,798,951 00	78	1,822,314 00	86	2,009,218 00
Sheeting and bracing	M. ft. B. M.	20	50 00	1,000 00	50 00	1,000 00	50 00	1,000 00	57 50	1,150 00	50 00	1,000 00	40 00	800 00
Channeling	sq. ft.	430,550	20	86,110 00	23	99,026 50	20	86,110 00	24	103,332 00	20	86,110 00	16	68,888 00
Forming embankment	cu. yds	26,800	15	4,020 00	15	4,020 00	15	4,020 00	18	4,824 00	15	4,020 00	12	3,216 00
Lining	"	6,950	1 50	10,425 00	1 65	11,467 50	1 50	10,425 00	1 70	11,815 00	1 50	10,425 00	1 20	8,340 00
Yellow pine or Douglas fir	M. ft. B. M.	12	55 00	660 00	55 00	660 00	55 00	660 00	65 00	780 00	55 00	660 00	44 00	528 00
Foundation piles	lin. ft.	770	30	231 00	30	231 00	30	231 00	35	269 50	30	231 00	24	184 80
2d class concrete	cu. yds	7,100	7 00	49,700 00	7 00	49,700 00	7 00	49,700 00	8 00	56,800 00	7 00	49,700 00	5 60	39,760 00
3d " "	"	37	6 50	240 50	6 50	240 50	6 50	240 50	7 00	259 00	6 50	240 50	5 20	192 40
Reinforced "	"	550	10 00	5,500 00	10 00	5,500 00	10 00	5,500 00	11 50	6,325 00	10 00	5,500 00	8 00	4,400 00
1st class masonry bridge coping	"	11	30 00	330 00	30 00	330 00	30 00	330 00	35 00	385 00	30 00	330 00	24 00	264 00
Wash-wall	"	38,520	2 50	96,300 00	2 75	105,930 00	2 50	96,300 00	2 90	111,708 00	2 50	96,300 00	1 00	38,520 00
2d class stone paving	sq. yds	30	1 50	45 00	1 50	45 00	1 50	45 00	1 70	51 00	1 50	45 00	1 20	36 00
3d " " "	"	1,100	1 25	1,375 00	1 25	1,375 00	1 25	1,375 00	1 40	1,540 00	1 25	1,375 00	1 00	1,100 00
2d " riprap	cu. yds	150	3 00	450 00	3 00	450 00	3 00	450 00	3 50	525 00	3 00	450 00	2 40	300 00
3d " "	"	300	2 50	750 00	2 50	750 00	2 50	750 00	2 90	870 00	2 50	750 00	2 00	600 00
4th " "	"	100	2 00	200 00	2 00	200 00	2 00	200 00	2 30	230 00	2 00	200 00	1 60	160 00
Structural steel	lbs.	627,140	05	31,357 00	05	31,357 00	05	31,357 00	06	37,628 40	05	31,357 00	04	25,085 60
Iron castings	"	5,286	03½	185 00	03½	185 01	03½	185 01	04	211 44	03½	185 01	028	148 00
Metal reinforcement	"	64,200	04	2,568 00	04	2,568 00	04	2,568 00	04½	2,889 00	04	2,568 00	032	2,054 40
Metal in guard-gate	"	525,000	06	31,500 00	06	31,500 00	06	31,500 00	07	36,750 00	06	31,500 00	048	25,200 00
Wood pavement 2½" thick	sq. yds	830	2 75	2,282 50	2 75	2,282 50	2 75	2,282 50	3 00	2,490 00	2 75	2,282 50	2 20	1,826 00
" " 3½" "	"	550	3 00	1,650 00	3 00	1,650 00	3 00	1,650 00	3 50	1,925 00	3 00	1,650 00	2 40	1,320 00
Wooden fence	lin. ft.	800	20	160 00	20	160 00	20	160 00	20	160 00	20	160 00	16	128 00
Lattice railing	"	700	2 00	1,400 00	2 00	1,400 00	2 00	1,400 00	2 30	1,610 00	2 00	1,400 00	1 60	1,120 00
Drilling bolt holes in rock	"	550	1 00	550 00	1 00	550 00	1 00	550 00	1 00	550 00	1 00	550 00	80	440 00
Trenching and backfilling for 48" pipe	"	66	2 00	132 00	2 00	132 00	2 00	132 00	2 00	132 00	2 00	132 00	1 60	105 60
Relaying 48" iron pipe	"	66	50	33 00	50	33 00	50	33 00	50	33 00	50	33 00	60	39 60
Maintaining navigation	lump sum	.....	5,000 00	5,000 00	5,000 00	5,000 00	5,000 00	5,000 00	5,000 00	5,000 00	5,000 00	5,000 00	4,000 00	4,000 00
" highway traffic	"	.....	500 00	500 00	500 00	500 00	500 00	500 00	500 00	500 00	500 00	500 00	400 00	400 00
				$2,519,443 00		$2,309,402 01		$2,285,813 01		$2,201,726 34		$2,168,998 01		$2,250,058 40
Deduct														
For buildings in place	"	.....	2,400 00		2,400 00		2,400 00		2,400 00	.....	2,400 00		2,400 00	
For bridge superstructures	"	.....	300 00	2,700 00	300 00	2,700 00	300 00	2,700 00	300 00	2,700 00	300 00	2,700 00	300 00	2,700 00
Total	.....	.....	.....	$2,516,743 00		$2,306,702 01		$2,283,113 01		$2,199,026 34		$2,166,298 01		$2,247,358 40

ITEM.	Measure.	Quantity.	Engineer's Estimate.		Morris Kantrowitz, Albany, N. Y.		Richard W. Sherman, Utica, A. A. Parker, Waterford; H. R. Beebe, Utica.		Sundstrom & Stratton, 90 West St, New York.		Wm. J. Oliver, Knoxville, Tenn.		Booth & Flinn, Ltd., Forbes and Jumonville Sts., Pittsburgh Pa.	
			Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.
Clearing	lump sum		$250 00	$250 00	$250 00	$250 00	$250 00	$250 00	$300 00	$300 00	$250 00	$250 00	$250 00	$250 00
Grubbing	cu. yds.	19,000	30	5,700 00	35	6,650 00	36	6,840 00	36	6,840 00	30	5,700 00	30	5,700 00
Excavation	"	1,072,000	25	268,000 00	23	246,560 00	23	246,560 00	26	278,720 00	19½	209,040 00	22½	241,200 00
Forming embankment	"	865,000	12	103,800 00	09	77,850 00	10	86,500 00	05	43,250 00	12	103,800 00	12	103,800 00
2d class concrete	"	320	10 00	3,200 00	9 00	2,880 00	10 00	3,200 00	12 00	3,840 00	10 00	3,200 00	10 00	3,200 00
4th class riprap	"	320	3 00	960 00	3 00	960 00	3 00	960 00	3 60	1,152 00	3 00	960 00	3 00	960 00
Expanded metal	sq. ft.	1,800	10	180 00	10	180 00	10	180 00	12	216 00	10	180 00	10	180 00
Maintaining highway tr	affic...lump sum		1,500 00	1,500 00	1,650 00	1,650 00	1,500 00	1,500 00	1,800 00	1,800 00	1,500 00	1,500 00	1,000 00	1,000 00
				$383,590 00		$336,980 00		$345,990 00		$336,118 00		$324,630 00		$356,290 00
Deduct for buildings			400 00	400 00	350 00	350 00	400 00	400 00	400 00	400 00	400 00	400 00	400 00	400 00
Total				$383,190 00		$336,630 00		$345,590 00		$335,718 00		$324,230 00		$355,890 00

ITEM.	Mason & Hanover Co., Millard & Lupton Co. 50 Church St., New York.		Arthur McMullen, 13 Park Row, New York.		Butler Bros., Hoff Co., 1170 Broadway, New York.		Patterson & Co., Fitzsimmons Bldg, Pittsburgh, Pa.		American Pipe Mfg. Co., 112 N. Broad St., Philadelphia, Pa.		Scott Bros., Baldwinsville, N. Y		Whitmore, Vicinus, N. Y.	Rauber & Rochester,
	Price.	Amount.	Price.	Amount.	Price.	Amonut.	Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.
Clearing	$250 00	$250 00	$250 00	$250 00	$250 00	250 00	$250 00	$250 00	$300 00	$300 00	$300 00	$300 00	$250 00	$250 00
Grubbing	30	5,700 00	30	5,700 00	30	5,700 00	30	5,700 00	36	6,840 00	35	6,650 00	50	9,500 00
Excavation	21	225,120 00	21	225,120 00	22	235,840 00	25	268,000 00	27	289,440 00	22	235,840 00	23	246,560 00
Forming embankment.	11	95,150 00	12	103,800 00	04	34,600 00	13¾	118,937 50	06	51,900 00	10½	90,825 00	10	86,500 00
2nd class concrete	10 00	3,200 00	10 00	3,200 00	10 00	3,200 00	11 00	3,520 00	10 00	3,200 00	9 00	2,880 00	8 00	2,560 00
4th class riprap	3 00	960 00	3 00	960 00	3 00	960 00	3 00	960 00	3 00	960 00	3 00	960 00	3 00	960 0
Expanded metal	10	180 00	10	180 00	10	180 00	10	180 00	10	180 00	10	180 00	10	180 0
Maintaining highway traffic	1,500 00	1,500 00	1,500 00	1,500 00	1,000 00	1,000 00	1,500 00	1,500 00	1,500 00	1,500 00	1,500 00	1,500 00	1,500 00	1,500 00
		$332,060 00		$340,710 00		$281,730 00		$399,047 50		$354,320 00		$339,135 00		$348,010 00
Deduct for buildings	400 00	400 00	400 00	400 00	400 00	400 00	400 00	400 00	400 00	400 00	400 00	400 00	800 00	800 00
Total		$331,660 00		$340,310 00		$281,330 00		$398,647 50		$353,920 00		$338,735 00		$347,210 00

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BIDS FOR CONTRACT NO. 41—(Continued).

ITEM.	Ryan & Harrington, 159 West 125th St., New York.		Clement King Co., Inc., 411 Land Title Bldg., Philadelphia, Pa.		The Miller Contracting Co., Inc., Lock Haven, Pa.		Acme Engineering and Contracting Co., Schenectady, N. Y.		Shanley Morrissey Co., Inc., 527 5th Ave., New York.		M. A. Cleveland, Brockport, N. Y.		Coast & Interior Contracting Co., Fayetteville, N. Y.	
	Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.
Clearing	$250 00	$250 00	$250 00	$250 00	$250 00	$250 00	$250 00	$250 00	$250 00	$250 00	$250 00	$250 00	$250 00	$250 00
Grubbing	30	5,700 00	30	5,700 00	30	5,700 00	30	5,700 00	30	5,700 00	30	5,700 00	30	5,700 00
Excavation	23	246,560 00	23	246,560 00	18	192,960 00	25½	273,360 00	18	192,960 00	20	214,400 00	24¾	265,320 00
Forming embankment	12	103,800 00	12	103,800 00	11	95,150 00	11½	99,475 00	10	86,500 00	12	103,800 00	12	103,800 00
2nd class concrete	10 00	3,200 00	9 50	3,040 00	10 00	3,200 00	10 00	3,200 00	10 00	3,200 00	10 00	3,200 00	10 00	3,200 00
4th class riprap	3 00	960 00	3 50	1,120 00	3 00	960 00	3 00	960 00	3 00	960 00	3 00	960 00	3 00	960 00
Expanded metal	10	180 00	10	180 00	10	180 00	10	180 00	10	180 00	10	180 00	10	180 00
Maintaining highway traffic	1,500 00	1,500 00	2,000 00	2,000 00	1,5000 00	1,500 00	1,500 00	1,500 00	1,500 00	1,500 00	1,500 00	1,500 00	1,500 00	1,500 00
		$362,150 00		$362,650 00		$299,900 00		$384,625 00		$291,250 00		$329,990 00		$380,910 00
Deduct for buildings	400 00	400 00	400 00	400 00	500 00	500 00	400 00	400 00	400 00	400 00	400 00	400 00	400 00	400 00
Total	.....	$361,750 00		$362,250 00		$299,400 00		$384,225 00		$290,850 00		$329,590 00		$380,510 00

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ITEM.	Measure.	Quantity.	Engineer's Estimate.		P. Sandford Ross, 277 Washington St., Jersey City, N. J.		Kinser Construction Co., Chicago, Ill., and Fort Edward, N. Y.	
			Price.	Amount.	Price.	Amount.	Price.	Amount.
Clearing	lump sum		$5,000 00	$5,000 00	$5,000 00	$5,000 00	$5,000 00	$5,000 00
Excavation	cu. yds.	5,035,000	20	1,007,000 00	217	1,092,595 00	17	855,950 00
Sheeting and bracing	M. ft. B. M.	25	50 00	1,250 00	50 00	1,250 00	50 00	1,250 00
Forming embankment	cu. yds.	72,000	15	10,800 00	18	12,960 00	10	7,200 00
Lining	"	1,800	1 50	2,700 00	1 50	2,700 00	1 50	2,700 00
Yellow pine or Douglas fir	M. ft. B. M.	11	55 00	605 00	65 00	715 00	55 00	605 00
White oak in sills and gates	"	8	100 00	800 00	100 00	800 00	100 00	800 00
Foundation piles, 15′ to 30′ long	lin. ft	154,000	25	38,500 00	25	38,500 00	25	38,500 00
Mooring piles, 20′ long	Pile	20	7 00	140 00	7 00	140 00	7 00	140 00
Wooden sheet-piling	M. ft. B. M.	362	50 00	18,100 00	50 00	18,100 00	50 00	18,100 00
2d class concrete	cu. yds.	31,000	6 25	193,750 00	6 45	199,950 00	6 25	193,750 00
Reinforced "	"	190	10 00	1,900 00	10 00	1,900 00	10 00	1,900 00
1st class masonry bridge coping	"	5	30 00	150 00	30 00	150 00	30 00	150 00
2d class riprap	"	3,800	2 50	9,500 00	2 50	9,500 00	2 50	9,500 00
Wrought iron pipe and specials, 2½"	lin. ft	250	20	50 00	20	50 00	20	50 00
Structural steel	lbs.	575,400	05	28,770 00	05	28,770 00	05	28,770 00
Metal reinforcement	"	26,800	04	1,072 00	04	1,072 00	04	1,072 00
Steel castings	"	12,800	05	640 00	05	640 00	05	640 00
Iron castings, machined	"	6,600	06	396 00	06	396 00	06	396 00
Wood pavement	sq. yds.	920	2 75	2,530 00	3 00	2,760 00	2 75	2,530 00
Wooden fence	lin. ft.	3,650	20	730 00	20	730 00	20	730 00
Wrought iron chain	lbs.	6,000	06	360 00	06	360 00	06	360 00
Sawed lumber in needles	M. ft. B. M.	18	100 00	1,800 00	100 00	1,800 00	100 00	1,800 00
Metal in buffer-beams	lbs.	96,000	06	5,760 00	06	5,760 00	06	5,760 00
" lock-valves	"	25,000	12	3,000 00	12	3,000 00	12	3,000 00
" lock-gates	"	188,000	06	11,280 00	06	11,280 00	06	11,280 00
Pairs of uprights	pair	4	300 00	1,200 00	300 00	1,200 00	300 00	1,200 00
Gates "A"	each	4	250 00	1,000 00	250 00	1,000 00	250 00	1,000 00
" "B"	"	4	375 00	1,500 00	375 00	1,500 00	350 00	1,400 00
Cast iron idlers	"	24	1 50	36 00	1 50	36 00	1 50	36 00
Bearing shoes	"	8	8 00	64 00	8 00	64 00	8 00	64 00
Machinery	lbs.	25,000	15	3,750 00	15	3,750 00	15	3,750 00
Coffer-dams, pumping, etc	lump sum		12,000 00	12,000 00	14,000 00	14,000 00	12,000 00	12,000 00
Removal of bridge superstructure	"		200 00	200 00	240 00	240 00	200 00	200 00
Maintaning highway traffic	"		1,500 00	1,500 00	1,800 00	1,800 00	1,500 00	1,500 00
				$1,367,833 00		$1,464,468 00		$1,213,083 00
Deduct for buildings			250 00	250 00	250 00	250 00	250 00	250 00
Total				$1,367,583 00		$1,464,218 00		$1,212,833 00

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ITEM.	Crowell & Sherman Co., 3111 Carnegie Ave., Cleveland, Ohio.		Shanley–Morrissey, Inc., 527 5th Ave., New York City.		North American Dredging Co., 839 Park Row Bldg., New York City.		American Pipe Mfg. Co., 112 N. Broad St., Philadelphia, Pa.		Booth & Flinn, Ltd., Forbes and Jumonville St., Pittsburg, Pa.	
	Price.	Amounts.	Price.	Amounts.	Price.	Amont.	Price.	Amount.	Price.	Amount.
Clearing	$5,900 00	$5,900 00	$6,000 00	$6,000 00	$6,000 00	$6,000 00	$4,000 00	$4,000 00	$5,000 00	$5,000 00
Excavation	18	906,300 00	18	906,300 00	179	901,265 00	20	1,007,000 00	1785	898,747 50
Sheeting and bracing	50 00	1,250 00	60 00	1,500 00	50 00	1,250 00	40 00	1,000 00	50 00	1,250 00
Forming embankment	15	10,800 00	18	12,960 00	18	12,960 00	12	8,640 00	15	10,800 00
Lining	1 50	2,700 00	1 80	3,240 00	1 50	2,700 00	1 20	2,160 00	1 50	2,700 00
Yellow pine or Douglas fir	55 00	605 00	66 00	726 00	55 00	605 00	44 00	484 00	55 00	605 00
White oak in sills and gates	100 00	800 00	120 00	960 00	100 00	800 00	80 00	640 00	100 00	800 00
Foundation piles, 15′ to 30′ long	25	38,500 00	30	46,200 00	25	38,500 00	20	30,800 00	25	38,500 00
Mooring piles, 20′ long	7 00	140 00	8 40	168 00	7 00	140 00	5 60	112 00	7 00	140 00
Wooden sheet-piling	50 00	18,100 00	60 00	21,720 00	50 00	18,100 00	40 00	14,480 00	50 00	18,100 00
2d class concrete	5 75	178,450 00	7 25	224,750 00	6 25	193,750 00	7 00	217,000 00	6 75	209,250 00
Reinforced "	10 00	1,900 00	12 00	2,280 00	10 00	1,900 00	8 00	1,520 00	10 00	1,900 00
1st class masonry bridge coping	30 00	150 00	36 00	180 00	30 00	150 00	24 00	120 00	30 00	150 00
2d class riprap	2 50	9,500 00	3 00	11,400 00	2 50	9,500 00	2 00	7,600 00	2 50	9,500 00
Wrought iron pipe and specials, 2½"	20	50 00	24	60 00	20	50 00	16	40 00	20	50 00
Structural steel	05	28,770 00	06	34,524 00	05	28,770 00	04	23,016 00	05	28,770 00
Metal reinforcement	04	1,072 00	05	1,340 00	04	1,072 00	032	857 60	04	1,072 00
Steel castings	05	640 00	06	768 00	05	640 00	04	512 00	05	640 00
Iron castings, machined	06	396 00	07	462 00	06	396 00	048	316 80	06	396 00
Wood pavement	2 75	2,530 00	3 30	3,036 00	2 75	2,530 00	2 40	2,208 00	2 75	2,530 00
Wooden fence	20	730 00	24	876 00	20	730 00	16	584 00	20	730 00
Wrought iron chain	06	360 00	07	420 00	06	360 00	048	288 00	06	360 00
Sawed lumber in needles	100 00	1,800 00	120 00	2,160 00	100 00	1,800 00	80 00	1,440 00	100 00	1,800 00
Metal in buffer-beams	06	5,760 00	07	6,720 00	06	5,760 00	048	4,608 00	06	5,760 00
" lock-valves	12	3,000 00	14	3,500 00	12	3,000 00	096	2,400 00	12	3,000 00
" lock-gates	06	11,280 00	07	13,160 00	06	11,280 00	048	9,024 00	06	11,280 00
Pairs of uprights	300 00	1,200 00	360 00	1,440 00	300 00	1,200 00	240 00	960 00	300 00	1,200 00
Gates "A"	250 00	1,000 00	300 00	1,200 00	250 00	1,000 00	200 00	800 00	250 00	1,000 00
" "B"	375 00	1,500 00	450 00	1,800 00	375 00	1,500 00	300 00	1,200 00	375 00	1,500 00
Cast iron idlers	1 50	36 00	1 80	43 20	1 50	36 00	1 20	28 80	1 50	36 00
Bearing shoes	8 00	64 00	9 60	76 80	8 00	64 00	6 40	51 20	8 00	64 00
Machinery	15	3,750 00	18	4,500 00	15	3,750 00	12	3,000 00	15	3,750 00
Coffer-dams, pumping, etc	12,000 00	12,000 00	14,400 00	14,400 00	14,400 00	14,400 00	14,400 00	14,400 00	12,000 00	12,000 00
Removal of bridge superstructures	200 00	200 00	240 00	240 00	200 00	200 00	160 00	160 00	200 00	200 00
Maintaining highway traffic	1,500 00	1,500 00	1,800 00	1,800 00	1,500 00	1,500 00	1,200 00	1,200 00	1,500 00	1,500 00
		$1,252,533 00		$1,330,910 0		$1,267,658 00		$1,362,650 40		$1,275,080 50
Deduct for buildings	250 00	250 00	200 00	200 00	250 00	250 00	250 00	250 00	250 00	250 00
Total		$1,252,283 00		$1,330,710 00		$1,267,408 00		$1,362,400 40		$1,274,830 50

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ITEM.	Measure.	Quantity.	Engineer's Estimate.		Booth & Flinn, Ltd. Forbes and Jumonville St., Pittsburg, Pa.		Butler Bros.–Hoff Co. 1170 Broadway, New York.		Crowell & Sherman Co., 3111 Carnegie Ave., Cleveland, Ohio.		American Pipe Mfg. Co., 112 N. Broad Street, Philadelphia, Pa.	
			Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.
Clearing	acre	50	$25 00	$1,250 00	$25 00	$1,250 00	$25 00	$1,250 00	$25 00	$1,250 00	$25 00	$1,250 00
Grubbing	cu. yds	890	30	267 00	30	267 00	30	267 00	30	267 00	30	267 00
Excavation	"	5,310,000	23	1,221,300 00	217	1,152,270 00	225	1,194,750 00	199	1,056,690 00	257	1,364,670 00
Sheeting and Bracing	M. ft. B. M.	25	50 00	1,250 00	50 00	1,250 00	50 00	1,250 00	50 00	1,250 00	50 00	1,250 00
Forming embankment	cu. yds	32,500	15	4,875 00	15	4,875 00	15	4,875 00	15	4,875 00	15	4,875 00
Lining	"	1,120	1 50	1,680 00	1 50	1,680 00	1 50	1,680 00	1 50	1,680 00	1 50	1,680 00
Yellow pine or Douglas fir	M. ft. B. M.	4	55 00	220 00	55 00	220 00	55 00	220 00	55 00	220 00	55 00	220 00
Hemlock	" "	32	50 00	1,600 00	50 00	1,600 00	50 00	1,600 00	50 00	1,600 00	50 00	1,600 00
White oak in mitre sills	" "	7	100 00	700 00	100 00	700 00	100 00	700 00	100 00	700 00	100 00	700 00
White oak	" "	1	80 00	80 00	80 00	80 00	80 00	80 00	80 00	80 00	80 00	80 00
Round timber in cribs	lin. ft	320	15	48 00	15	48 00	15	48 00	15	48 00	15	48 00
Stone filling in cribs	cu. yds	410	1 50	615 00	1 50	615 00	1 50	615 00	1 50	615 00	1 50	615 00
Foundation piles, 15′ to 24′	lin. ft	2,100	25	525 00	25	525 00	25	525 00	25	525 00	25	525 00
Mooring piles, 20′ long	each	8	7 00	56 00	7 00	56 00	7 00	56 00	7 00	56 00	7 00	56 00
Wooden sheet-piling	M. ft. B. M.	7	50 00	350 00	50 00	350 00	50 00	350 00	50 00	350 00	50 00	350 00
Second class concrete	cu. yds	23,000	6 40	147,200 00	6 50	149,500 00	6 00	138,000 00	6 10	140,300 00	6 40	147,200 00
Reinforced concrete	"	113	10 00	1,130 00	10 00	1,130 00	10 00	1,130 00	10 00	1,130 00	10 00	1,130 00
1st class masonry bdge cop	"	2	30 00	60 00	30 00	60 00	30 00	60 00	30 00	60 00	30 00	60 00
2d class stone paving	sq. yds	50	1 50	75 00	1 50	75 00	1 50	75 00	1 50	75 00	1 50	75 00
2d class riprap	cu. yds	860	2 50	2,150 00	2 50	2,150 00	2 50	2,150 00	2 50	2,150 00	2 50	2,150 00
15″ vitrified pipe, laid	lin. ft	865	60	519 00	60	519 00	60	519 00	60	519 00	60	519 00
Trenching and backfilling	"	865	30	259 50	30	259 50	30	259 50	30	259 00	30	259 00
Structural steel	lbs.	158,000	05	7,900 00	05	7,900 00	04	6,320 00	05	7,900 00	05	7,900 00
Metal reinforcement	"	23,000	04	920 00	04	920 00	04	920 00	04	920 00	04	920 00
Wrought iron	"	1,750	04	70 00	04	70 00	04	70 00	04	70 00	04	70 00
Steel castings	"	10,400	05	520 00	05	520 00	05	520 00	05	520 00	05	520 00
Iron castings, plain	"	2,000	03½	70 00	03½	70 00	03½	70 00	03½	70 00	03½	70 00
" machined	"	6,600	06	396 00	06	396 00	06	396 00	06	396 00	06	396 00
Wood pavement	sq. yds	330	2 75	907 50	2 75	907 50	2 75	907 50	2 75	907 50	2 75	907 50
Wooden fence	lin. ft	925	20	185 00	20	185 00	20	185 00	20	185 00	20	185 00
Wrought iron pipe ruling	"	470	1 00	470 00	1 00	470 00	1 00	470 00	1 00	470 00	1 00	470 00
Sawed lumber in needles	M. ft. B. M.	14	100 00	1,400 00	100 00	1,400 00	100 00	1,400 00	100 00	1,400 00	100 00	1,400 00
Metal in lock-valves	lbs.	24,000	10	2,400 00	10	2,400 00	10	2,400 00	10	2,400 00	10	2,400 00
" buffer-beams	"	90,000	06	5,400 00	06	5,400 00	05	4,500 00	06	5,400 00	06	5,400 00
" lock-gates	"	180,000	06	10,800 00	06	10,800 00	05	9,000 00	06	10,800 00	06	10,800 00
Maintaining highway traffic	lump sum	.....	500 00	500 00	500 00	500 00	500 00	500 00	500 00	500 00	500 00	500 00
Coffer-dams, pumping, etc.	" "	.....	16,000 00	16,000 00	16,000 00	16,000 00	16,000 00	16,000 00	16,000 00	16,000 00	16,000 00	16,000 00
Total	.....	.....	.....	$1,434,148 00	.....	$1,367,418 00	.....	$1,394,118 00	.....	$1,262,638 00	.....	$1,577,518 00

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ITEM.	Measure.	Quantity.	Engineers' Estimate.		Acme Co.		The H. J. McCain Construction Co, Merchia, Pa.		Booth & Flinn, Ltd.	
			Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.
Clearing	lump sum	.....	$100 00	$100 00	$100 00	$100 00	$100 00	$100 00	$100 00	$100 00
Grubbing	cu. yds	4,800	35	1,680 00	35	1,680 00	35	1,680 00	35	1,680 00
Excavation	"	550,000	90	495,000 00	1 00	550,000 00	75	412,500 00	84	462,000 00
Sheeting and bracing	M. ft. B. M	50	50 00	2,500 00	50 00	2,500 00	50 00	2,500 00	50 00	2,500 00
Round timber bracing	lin. ft	1,000	25	250 00	25	250 00	25	250 00	25	250 00
Channeling	sq. ft	170,000	18	30,600 00	25	36,550 00	16	27,200 00	18	30,600 00
Embankment, wet	cu. yds	30,000	05	1,500 00	05	1,500 00	05	1,500 00	05	1,500 00
" dry	"	43,000	12	5,160 00	12	5,160 00	12	5,160 00	12	5,160 00
Lining	"	510	1 50	765 00	1 50	765 00	1 50	765 00	1 50	765 00
Yellow pine or Douglas fir	M. ft. B. M	5.6	55 00	308 00	55 00	308 00	55 00	308 00	55 00	308 00
" in needles	"	14	100 00	1,400 00	100 00	1,400 00	100 00	1,400 00	100 00	1,400 00
White oak in sills and gates	"	25	100 00	2,500 00	100 00	2,500 00	100 00	2,500 00	100 00	2,500 00
Foundation piles	lin. ft	3,000	35	1,050 00	35	1,050 00	35	1,050 00	35	1,050 00
2nd class concrete	cu. yds	68,000	7 25	493,000 00	8 00	544,000 00	6 50	442,000 00	6 95	472,600 00
Reinforced concrete	"	1,500	9 00	13,500 00	10 80	16,200 00	9 00	13,500 00	10 00	15,000 00
1st class masonry coping	"	5	30 00	150 00	30 00	150 00	30 00	150 00	30 00	150 00
Wash-wall	"	2,000	2 50	5,000 00	2 50	5,000 00	2 50	5,000 00	2 50	5,000 00
3rd class stone paving	sq. yds	72	1 25	90 00	1 25	90 00	1 25	90 00	1 25	90 00
4th class riprap	cu. yds	200	2 50	500 00	2 50	500 00	2 50	500 00	2 50	500 00
Structural steel	lbs	180,000	05	9,000 00	05	9,000 00	05	9,000 00	05	9,000 00
Metal reinforcement	"	61,000	04	2,440 00	04	2,440 00	04	2,440 00	04	2,440 00
Iron castings, plain	"	28,000	035	980 00	035	980 00	035	980 00	035	980 00
" machined	"	26,000	06	1,560 00	06	1,560 00	06	1,560 00	06	1,560 00
Metal in lock-gates	"	770,000	06	46,200 00	06	46,200 00	05	38,500 00	06	46,500 00
" buffer-beams	"	240,000	06	14,400 00	06	14,400 00	06	14,400 00	06	14,400 00
" lock-valves	"	100,000	12	12,000 00	12	12,000 00	12	12,000 00	12	12,000 00
Wooden pavement, 4" thick	sq. yds	380	3 00	1,080 00	3 00	1,080 00	3 00	1,080 00	3 00	1,080 00
" fence	lin. ft	1,150	20	230 00	20	230 00	20	230 00	20	230 00
Drilling bolt holes in rock	"	1,300	60	780 00	72	936 00	60	780 00	60	780 00
Raising bridge superstructure	lump sum	.....	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00
Maintaining highway traffic	"	.....	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00
Storehouses	each	3	800 00	2,400 00	800 00	2,400 00	800 00	2,400 00	800 00	2,400 00
Office buildings	"	2	250 00	500 00	250 00	500 00	250 00	500 00	250 00	500 00
Coffer-dams, pumping, etc	lump sum	.....	25,000 00	25,000 00	25,000 00	25,000 00	30,000 00	30,000 00	25,000 00	25,000 00
Total	.....	.....	.....	$1,175,623 00	.....	$1,290,429 00	.....	$1,036,023 00	.....	$1,123,723 00

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ITEM.	Mason & Hanger Co., Millard & Lupton Co.		American Pipe Mfg. Co.		Shanley-Morrissey, In.		Scott Bros., Baldwinsville, N. Y.		McArthur Bros. Co., 11 Pine Street, New York.		Coast & Interior Contracting Co., Fayetteville, N. Y.	
	Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.
Clearing	$100 00	$100 00	$80 00	$80 00	$100 00	$100 00	$100 00	$100 00	$100 00	$100 00	$100 00	$100 00
Grubbing	35	1,680 00	28	1,344 00	35	1,680 00	35	1,680 00	40	1,920 00	35	1,680 00
Excavation	73	401,500 00	1 00	550,000 00	75	412,500 00	82	451,000 00	82	451,000 00	74	407,000 00
Sheeting and bracing	50 00	2,500 00	40 00	2,000 00	50 00	2,500 00	50 00	2,500 00	60 00	3,000 00	60 00	3,000 00
Round timber bracing	25	250 00	20	200 00	25	250 00	25	250 00	30	300 00	30	300 00
Channeling	21	35,700 00	144	24,480 00	14	23,800 00	18	30,600 00	21	35,700 00	18	30,600 00
Embankment, wet	05	1,500 00	04	1,200 00	05	1,500 00	05	1,500 00	06	1,800 00	05	1,500 00
" dry	12	5,160 00	096	4,128 00	12	5,160 00	14	6,020 00	14	6,020 00	12	5,160 00
Lining	1 50	765 00	1 20	612 00	1 50	765 00	1 50	765 00	1 80	918 00	1 50	765 00
Yellow pine or Douglas fir	55 00	308 00	44 00	246 40	55 00	308 00	55 00	308 00	65 00	364 00	66 00	369 60
" " in needle	100 00	1,400 00	80 00	1,120 00	100 00	1,400 00	100 00	1,400 00	100 00	1,400 00	100 00	1,400 00
White oak in sills and plates	100 00	2,500 00	80 00	2,000 00	100 00	2,500 00	100 00	2,500 00	90 00	2,250 00	100 00	2,500 00
Foundation piles	35	1,050 00	28	840 00	35	1,050 00	35	1,050 00	40	1,200 00	40	1,200 00
2d class concrete	7 10	482,800 00	7 50	510,000 00	6 25	425,000 00	6 90	469,200 00	7 00	476,000 00	6 75	459,000 00
Reinforced "	10 00	15,000 00	8 00	12,000 00	9 00	13,500 00	9 00	13,500 00	9 00	13,500 00	10 50	15,750 00
1st class masonry coping	30 00	150 00	24 00	120 00	30 00	150 00	35 00	175 00	30 00	150 00	36 00	180 00
Wash-wall	2 50	5,000 00	2 00	4,000 00	2 50	5,000 00	2 50	5,000 00	2 80	5,600 00	2 50	5,000 00
3d class stone paving	1 25	90 00	1 00	72 00	1 25	90 00	1 25	90 00	1 45	104 40	1 50	108 00
4th class riprap	2 50	500 00	2 00	400 00	2 50	500 00	2 50	500 00	2 75	550 00	3 00	600 00
Structural steel	05	9,000 00	04	7,200 00	05	9,000 00	05	9,000 00	06	10,800 00	045	8,100 00
Metal reinforcement	04	2,440 00	032	1,952 00	04	2,440 00	04	2,440 00	04	2,440 00	04	2,440 00
Iron castings, plain	035	980 00	028	784 00	035	980 00	035	980 00	04	1,120 00	035	980 00
" machined	06	1,560 00	048	1,248 00	06	1,560 00	06	1,560 00	07	1,820 00	06	1,560 00
Metal in lock gates	06	46,200 00	048	36,960 00	06	46,200 00	06	46,200 00	06	46,200 00	055	42,350 00
" buffer-beams	06	14,400 00	048	11,520 00	06	14,400 00	06	14,400 00	07	16,800 00	055	13,200 00
" lock-valves	12	12,000 00	096	9,600 00	12	12,000 00	12	12,000 00	11	11,000 00	10	10,000 00
Wooden pavement, 4" thick	3 00	1,080 00	2 40	864 00	3 00	1,080 00	3 20	1,152 00	2 90	1,044 00	3 00	1,080 00
" fence	20	230 00	16	184 00	20	230 00	20	230 00	22	253 00	24	276 00
Drilling bolt holes in rock	60	780 00	48	624 00	60	780 00	60	780 00	60	780 00	60	780 00
Raising bridge superstructure	2,000 00	2,000 00	1,600 00	1,600 00	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00	2,000 00
Maintaining highway traffic	2,000 00	2,000 00	1,600 00	1,600 00	2,000 00	2,000 00	2,000 00	2,000 00	1,000 00	1,000 00	2,000 00	2,000 00
Storehouses	800 00	2,400 00	640 00	1,920 00	800 00	2,400 00	850 00	2,550 00	750 00	2,250 00	800 00	2,400 00
Office buildings	250 00	500 00	200 00	400 00	250 00	500 00	300 00	600 00	300 00	600 00	250 00	500 00
Coffer-dams, pumping, etc	25,000 00	25,000 00	30,000 00	30,000 00	25,000 00	25,000 00	30,000 00	30,000 00	28,000 00	28,000 00	25,000 00	25,000 00
Total		$1,078,523 00		$1,221,298 40		$1,018,323 00		$1,114,030 00		$1,127,983 40		$1,048,878 60

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A Great Waterway and the Official Machinery that Builds It.

As viewed from a comfortable Pullman, the Erie canal does not attract much attention from the casual observer, but in the minds of those who know its story the placid waters awaken emotions of interest and enthusiasm. To those who have studied its history it recalls the bitter struggles of many years — in legislative halls and at the polls, upon the rostrum and through the press — struggles that attended its every step from its inception more than a century ago, through various enlargements, to the present building of a Barge canal. To the political economist, engaged in studying the development of the world's commerce, it presents a connecting link between the vast ore and grain-producing States of the Northwest and the consumers of Europe, through the great distributing port of New York. To those who for years have been connected with the State departments, who have had charge of the construction, maintenance and operation of the old system, who realize the vast sums of money involved and the enormous amount of labor and thought that have been expended in the past, and who are familiar with the daily difficulties and problems which are now being encountered and overcome in the construction of the new Barge canal system, to those it stands as a monument of great work accomplished and a promise of greater achievement in the future.

As the Erie canal of old blazed the way for inland waterways in America, inspiring a veritable mania for canal-building throughout the country, so again, if present indications show the trend of public sentiment, the new Erie seems destined to lead in another popular wave of zeal for modern waterway channels; as the old Erie honored the names of the men instrumental in its building, so also it is probable that those who have been connected with the new project in some official capacity — as promoters, designers, supervisors or builders — will point with pride to their part in so great an undertaking.

It is the purpose of this article to show something of the official machinery that was set in motion by the Barge Canal Law, for it is not generally known to how great an extent the several State departments are actively engaged in this enterprise, nor how large and complex is the organization necessary for its proper execution. To this description a slight personal touch is given by adding a few photographs of some of the officials at work.

It is not necessary to enter extensively into a historical review of the Barge canal movement, but it seems pertinent to see by

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what agencies the project reached the stage of actual construction. Just after the attempt to deepen the canals to nine feet had failed and at the time of Governor Roosevelt's inauguration on January 1, 1899, the question as to what should be the future canal policy of the State was considered one of the most vital and important matters awaiting his consideration, as it was manifestly unwise to leave them in their incomplete condition. Accordingly, early in January, 1899, Governor Roosevelt appointed a committee consisting of Francis V. Greene, George E. Green, John N. Scatcherd, Thomas W. Symons, Frank S. Witherbee, Edward A. Bond and John N. Partridge (the latter two being respectively State Engineer and Superintendent of Public Works) with instructions to investigate the whole subject and recommend the proper policy for the State to adopt.

The committee thus appointed proceeded to carry out its work in a most thorough and systematic manner. Public meetings were held throughout the state; a voluminous correspondence was commenced with prominent citizens qualified to give competent advice and assistance; newspaper clippings containing every editorial published on the subject and representing the opinion of the various localities were collected and tabulated; an enormous amount of statistics regarding freight rates, the tonnage carried by rail and by water, the shipments from the various Atlantic ports and that passing down through the great lakes for foreign and domestic use, was obtained and carefully tabulated, together with a large amount of data from foreign countries where the subject of transportation of freight by water had of recent years received more attention than in this country.

The duties of the committee were concluded in January, 1900, and its report submitted to the Governor, together with the statistics, which constituted in scope and accuracy the most complete and valuable data which had ever been gathered together on the subject and proved of inestimable value in the future deliberations and discussions which took place in the Legislature and throughout the state. The committee reported unanimously that in its opinion the canal system of the state should not only not be abandoned, but that it should be enlarged to a depth of not less than twelve feet in order to accommodate boats carrying a cargo of one thousand tons, and expressed the opinion that such action was necessary to maintain the supremacy of New York as an export city and in order to prevent the diversion of traffic from the Northwest through the Canadian ports.

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The report was transmitted by Governor Roosevelt to the Legislature of 1900, with a recommendation that an appropriation be made for the purpose of enabling the State Engineer to make accurate surveys and estimates of cost of the enlargement of the canal system along the lines suggested by the report, and this recommendation was adopted by the Legislature in appropriating $200,000 and directing the State Engineer immediately to proceed with the work.

While the time allotted for carrying out these directions was extremely short and the work was therefore pushed with great vigor, yet the great importance of accuracy in preparing the estimates of cost and the necessity for securing the best possible location was fully realized by the State Engineer, and early in the proceedings he appointed an advisory board of consulting engineers, consisting of George S. Morison and William H. Burr, formerly of the Isthmian Canal Commission, Majors Thomas W. Symons and Dan C. Kingman, of the U. S. Army Engineer Corps, and Elnathan C. Sweet, ex-State Engineer, all eminent engineers and especially qualified by practical experience in canal work to be of great assistance.

The State Engineer's report, giving in great detail the results of the surveys and estimates for the enlargement of the canal system over several alternate routes, was completed and submitted to Governor Odell in February, 1901, and by him transmitted to the Legislature of that year, but no decisive action was taken until 1903. In the meantime the subject was thoroughly discussed by the press throughout the state and fully debated in the Legislatures of 1901, 1902 and 1903. In the latter year a law was enacted, authorizing the issuance of bonds for one hundred and one millions of dollars for the purpose of improving the Erie, the Oswego and the Champlain canals and this measure, when submitted to the people at the next general election, was ratified by a substantial majority.

Such in brief were the preliminary stages of the project. Turning now to the statements concerning the various boards, departments and officials, we may see how each fits in to form the whole mechanism.

Canal Board.

For many years the Canal Board has been the chief governing body in supervising the canal affairs of the state. The Barge canal act does not abridge its powers, but specifically defines its duties in such fashion as to give it final control, no individual

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officer being allowed, without the Board's approval, to go beyond certain well-defined and safe limits.

After plans and estimates of cost have been made, they must be approved by the Canal Board before the letting of contracts, and subsequently no alterations may be made, without its consent, that will increase the cost of the work. No contract may be awarded on a proposal that exceeds the estimated cost by more than a fixed amount, and during construction no single item of work may overrun the estimate by more than a small percentage, unless the Board determines whether the excessive work shall be done under the original contract, by the Superintendent of Public Works or by special contract. The Board may also suspend the work of any contract, if it is not being done in a satisfactory manner, and may order the Superintendent of Public Works to proceed with the work or relet to another contractor.

The Canal Board is composed of the following state officers: Lieutenant-Governor, Secretary of State, Comptroller, State Treasurer, Attorney-General, Superintendent of Public Works and State Engineer and Surveyor.

These officers, except the Superintendent of Public Works and the State Engineer and Surveyor, are also Commissioners of the Canal Fund — a body that antedates the Canal Board by nine years in point of existence, having been created by the act which authorized the building of the original Erie canal. This Board is intrusted with the supervision of the Canal Fund.

Advisory Board of Consulting Engineers.

In defining the connection of the Advisory Board of Consulting Engineers with Barge canal work it seems best, first, to quote the law, chapter 147, act of 1903.

"The Governor may employ, at a compensation to be fixed by him, five expert civil engineers to act as an advisory board of consulting engineers, whose duty it shall be to advise the State Engineer and the Superintendent of Public Works, to follow the progress of the work and from time to time report thereon to the Governor, the State Engineer and the Superintendent of Public Works, as they may require or the board may deem proper and advisable."

Second, to quote a statement unanimously adopted at a conference held at Albany, N. Y., on April 2, 1907, which was attended by representatives of the following organizations: Buffalo Chamber of Commerce, Canal Association of Western New York, New York Produce Exchange, New York Board of Trade and Transporta-

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Mortimer G. Barnes. Alfred Brooks Fry. Edward A. Bond, *Chairman.* Wm. A. Brackenridge. Wm. B. Landreth, *Engineer-Secretary.* Thomas W. Symons.

ADVISORY BOARD OF CONSULTING ENGINEERS.

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tion, Champlain Canal Association, Oswego Chamber of Commerce, Merchants' Association of New York, Canal Association of Greater New York (comprising twenty commercial and trade bodies), Fulton Chamber of Commerce, Canajoharie Board of Trade, Oswego Lumberman's Association, Rome Board of Trade, State Commerce Convention of Commercial Bodies, and New York State Canal Executive Committee.

"The barge canal is a great engineering undertaking. The improvement will be a work of several years, while the state administration changes every two years, and each succeeding State Engineer, Superintendent of Public Works and Canal Board may have different policies and theories regarding canal construction. It is imperative that both for the solution of the problems of construction and to preserve a unity of plan and operation during these changes of administration there should exist an advisory board of consulting engineers of a high order of ability and character, with permanent tenure of office and absolutely out of the reach of the disturbance of party politics; and that their duties should be advisory as to general plans and supervisory merely as to details of execution. Such is the Advisory Board of Consulting Engineers as now constituted, and, when the Barge Canal Law was presented to the people, great stress was laid upon the character of this board."

Third. To state that the Board has fully realized its responsibilities and has done its best to be faithful to the trust imposed.

Early in 1904 the Governor appointed as members of the Board, Edward A. Bond, chairman, William A. Brackenridge, Elmer L. Corthell, Alfred B. Fry and Thomas W. Symons. Upon Mr. Corthell's resignation in 1907, he was succeeded by Mortimer G. Barnes.

Superintendent of Public Works.

Though the statute authorizing the construction of the Barge canal specifies that the Superintendent of Public Works, in connection with the State Engineer, shall "proceed to improve the Erie canal, the Oswego canal and the Champlain canal," it is most probable that even those who are especially interested in the project as a whole have but a very slight conception as to the special functions of the Superintendent of Public Works in connection with the enterprise.

While that official does not have to do with the inception of plans, he has intimate relations at every point, once the plans

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OFFICE OF THE SUPERINTENDENT OF PUBLIC WORKS.

Scene at an opening of proposals for contracts. The Superintendent, Frederick C. Stevens, sits at the head of the table, opening the bids. At his right is Winslow M. Mead, Deputy Superintendent, reading the proposals; at his left, P. J. McWeeney, Financial Clerk, recording the certified checks; next to the left, Wm. R. Hill, Special Deputy State Engineer, the others at the table being men from the Special Deputy's office, canvassing the bids.

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have been prepared. The work in its inception and the manner in which it is provided by statute to be carried forward may be best likened to the construction of a building, where there is a triple relationship and interest, that of the architect and designer, the contractor and builder and the owner. In this work the State Engineer occupies a position akin to that of architect and designer; the contractor for the work, that of the contractor and builder; and the Superintendent of Public Works, for the purpose of simile, performs the functions of the owner, inasmuch as it is the finished product he at all times has in mind, and inasmuch as, when the product is a finished one, it passes to his jurisdiction for supervision and operation.

Under the statute, before they may become effective, the plans must be approved by the Canal Board, and the Superintendent of Public Works, as a member of that board, has a voice in their approval. Inasmuch, however, as the members of the Canal Board, outside of the State Engineer and the Superintendent of Public Works, may be supposed to have less knowledge of the technical details of the work, the judgment of the Superintendent of Public Works and the State Engineer, it may be said, is generally accepted and followed, and this being so, the custom has been established, as a result of an understanding reached between the two departments — the Department of the State Engineer and the Department of Public Works,— of submitting the plans and specifications to the Superintendent of Public Works for his inspection and examination before their submission to the Canal Board. This method has been found to work most satisfactorily, since any points of difference between the two officials as to plans and specifications have thus been adjusted before the actual submission of plans and specifications to the Canal Board.

When the plans and specifications for any of the work have received the approval of the Canal Board and are duly adopted, the Superintendent of Public Works proceeds to place all matter in connection with the work to be let in suitable form for submission to bidders. Under his direction the contract book is printed, which contains under the heading of "Information to Proposers" the terms and conditions under which proposals may be offered and also other data which will assist the bidder in observing the formalities. The next item in the contract book is the preliminary estimate of the work, which is prepared and furnished by the State Engineer. The form of proposal is then

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given, in which the bidder must make his proposal by items, with a declaration at the end thereof as to all who may be interested with him in the bid as principal. Following the proposal, the forms of agreement and bonds which the successful bidder must execute are set forth; and no bidder is given the slightest ground to complain that he was at all in the dark as to the obligations which, by the submission of a bid for the work, he agrees to assume if awarded the contract. Two bonds are required to be executed and delivered to the State by the contractor, and the surety of a responsible bonding company is required in every case. One bond, being known as the "Faithful Performance Bond," is for 25 per cent of the contract price according to the proposal, and is conditioned that the contractor will well and faithfully perform the work according to the plans and specifications; the other, being for 10 per cent of the proposal, guarantees that the contractor will pay all laborers employed by him on the work in full at least once in each month. In many cases the amount of the faithful performance bond is so large that no one surety company may properly assume the obligation of surety, and in these cases the plan of re-insurance or co-insurance is resorted to. The contract book is completed by the insertion of the technical specifications for the work, which are prepared and furnished by the State Engineer. Thus the information and data contained in this pamphlet, together with the plans and drawings of the work, provide the bidder with the most minute details concerning the work for which he is contemplating a proposal.

Immediately upon the receipt of plans for the work and the completion of the printing of the contract books, the date on which sealed proposals for the contract in hand shall be received is fixed by the Superintendent of Public Works, though effort is at all times made to combine in one advertisement as many pieces of work as is possible without unduly delaying the asking of bids.

The Superintendent of Public Works selects the newspapers in which the advertisement of the contract to be let shall appear, the law requiring its publication in two papers in the city of New York, one of which shall be devoted to engineering and contracting interests, and in one paper in each of the cities of Albany, Syracuse, Rochester and Buffalo. Under the statute the advertisement must appear also in a newspaper in every county in which the work or a part of the work may be located. The period

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of advertisement is four weeks, the notice being published once in each week before the date set for the opening. The published advertisement of the work contains, besides the time fixed for the opening of the sealed bids, a brief description of the work advertised and its location, the terms on which bids will be received and other necessary information. Blue-prints of the plans are on exhibition in the Superintendent's office in the Capitol, and also in the Canal Division offices in the cities of Syracuse, Rochester and Buffalo, where also specifications may be obtained by prospective bidders on application without any charge whatever.

With each proposal a deposit of five per cent of the amount thereof is required. This must be in the form of a certified check or draft upon some good banking institution in the city of New York or Albany, issued by a National or State bank in good credit within the State and payable at sight to the Superintendent of Public Works. This deposit is exacted to insure good faith on the part of the proposer, and in case the proposer to whom a contract shall be awarded shall fail or refuse to enter into such contract within ten days from the date of notice of award to him, such deposit is forfeited to the State, paid to the Treasurer and becomes part of the Canal Fund. As soon as the contract and bonds are properly executed and accepted, the amount of the deposit is returned to the successful bidder. The deposits of those who are found not to be the lowest bidders are returned immediately after the amounts of the bids have been ascertained.

Large sums come into the hands of the Superintendent of Public Works in the form of deposits with bids and great effort is made to return to the unsuccessful bidders their deposits at the earliest possible moment, to the end that they shall not be deprived of the use of such large sums longer than is absolutely necessary. At the lettings of November 17 and 18 last, when five separate contracts were awarded, forty-four proposals were received and the deposits submitted with the bids aggregated a total of $2,313,-174.76. Although the time for the opening of the proposals was fixed at 12 o'clock noon, and several hours each day were consumed in the reading of the itemized prices of the bids and the tabulation and canvassing of the figures by the engineers, the deposits were in the hands of all those, except the lowest bidder in each case, who desired their return, before the close of business on each day.

The largest amount of publicity is given by the Superintendent of Public Works to proposed lettings of contracts. While the paid

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official advertisements of the work are limited to the newspapers in the locations prescribed in the statute, a list of all contractors, who have at any time shown an interest in the project or have offered bids, is carefully kept, and proof slips of the official notice are promptly mailed to them. In addition to this, announcement of the fact that bids are being asked on the contracts is made to the press and such fact is published as a news item in every newspaper and engineering publication in the eastern states, and this without the slightest expense to the State.

The bids are opened at the Superintendent's office in the Capitol at 12 o'clock noon of the date set, and the opening takes place with the Superintendent of Public Works presiding and the Deputy Superintendent of Public Works opening the proposals and reading in detail the item prices of each. The reading of the bids is attended by the Special Deputy State Engineer and his corps of assistants for the purpose of tabulating and canvassing the bids, and by one or more members of the Advisory Board. Many contractors and their representatives, together with others directly and indirectly interested in the work, are also present, and at times of the letting of large pieces of work, bids are read in the presence of several hundred persons. While the assembly room of the Department of Public Works has usually been found sufficient to accommodate all spectators, on several occasions it has been found necessary to adjourn to the Assembly parlor on the third floor of the Capitol in order to secure room for the large crowd desiring to witness the opening.

When the lowest bid is revealed by the tabulation and canvass of all the figures submitted, the Superintendent at once proceeds to examine this bid in order to ascertain whether it is within the statutory limits of the estimate and whether it possesses any unbalanced features. Under the Barge Canal Law no award may be made that is based on any bid, the total of which exceeds by more than 10 per cent the gross amount of the engineer's estimate, or when the price bid for any item is more than 20 per cent in excess of the estimate for such item, unless such award has been duly approved by the State Engineer and the Canal Board. If the bid is found to be a proper one and formal in every respect, an investigation is then made by the Superintendent as to the standing of the proposer and concerning his resources and ability to perform the contract. When the award is finally made by the Superintendent and the sureties offered are to his satisfaction, the contract is executed in quadruplicate, one copy each being delivered to the

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contractor, the Comptroller and the State Engineer, the fourth copy being on file in the Superintendent's office.

No contract may be assigned or transferred without the approval of the Superintendent of Public Works, and no such approval is given without the strictest scrutiny of the reasons for such assignment and the standing and resources of the proposed assignee.

The actual work being once placed under way, the contractor receives his compensation from the Superintendent. Estimates of the work done are certified monthly to the Superintendent by the State Engineer. While the Superintendent, under the statute, may pay upon the Engineer's certificate 90 per cent of the amount of work done, as shown by the Engineer's monthly estimate, he has taken the view that, should he rely solely on this certificate and were it to be found that payment had been made improperly, he would not be held entirely blameless, and therefore, as an added precaution, upon request to the Legislature, he has been provided with an Advisory Engineer to assist him in the examination of these estimates. The present Advisory Engineer is Mr. Joseph Ripley, formerly of the Sault canal and later first assistant engineer on the Panama canal. In addition to such special service and advice that is furnished by the Advisory Engineer, the Superintendent of Public Works takes the added precaution of requiring the Advisory Board of Consulting Engineers to attach to each estimate of work done a certificate, signed by a majority of the individual members of the Board, attesting to the conformity of the work done with the requirements of the plans and specifications.

The estimates having been duly certified and found correct in every detail, they are forwarded by the Superintendent to the contractor for his acceptance; upon receipt of such estimate by the Superintendent with the contractor's acceptance and receipt thereon, a draft on the Comptroller for 90 per cent. of the full amount of the estimate is at once sent to the contractor. When the work shall be fully completed and formally accepted by the State Engineer and the Superintendent of Public Works on behalf of the State, what is known as a "final estimate" will be prepared, which will contain, in addition to the amount due for any work done since the payment of the last previous estimate, the total of the retained percentages withheld by the State from each monthly estimate during the progress of the work.

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During the progress of the work no alteration of any kind may be made in any map, plan or specification, unless such alteration shall be first submitted to and approved by the Superintendent of Public Works, the State Engineer's approval having previously been given; and under the statute, should the proposed alteration of the plans or specifications entail an increase of cost to the State or create any claim against the State for damage of any kind, then it must be submitted to the Canal Board for its approval.

When the maps and description of lands needed for Barge canal purposes have been prepared by the State Engineer and approved by the Canal Board, the Superintendent causes such maps, together with the appropriation papers, to be served upon the owners of the property to be taken. In addition to the examination and appraisal of property taken, made by the Special Examiner and Appraiser, an independent examination of the property is caused to be made by the Superintendent, and the valuations fixed by both agents must substantially agree. When agreement is made by the Special Examiner and Appraiser with the owner of appropriated property as to the amount to be paid by the State, such agreement must receive the Superintendent's approval and is presented by that official to the Canal Board for its approval. Copies of all claims brought against the State in the Court of Claims on account of the Barge canal work must be filed in the Department of Public Works.

In the case of buildings, appropriated by the State, and existing on the contract site, deemed unnecessary for the State's use in connection with the work, authority is given the Superintendent of Public Works to sell such buildings to the person offering the highest price for them, the sale being conditioned on the removal of the structures from the contract site.

Not the least difficulty met by the Superintendent of Public Works in connection with this whole work arises from the fact that under the general statute, as well as the statute which authorizes this improvement of the canals, that official is charged with the duty of maintaining navigation on the present canals during the period of improvement. He is thus in the position of standing between what would seem to be almost opposing interests — the boatmen, forwarders and shippers, doing business on the canals of to-day and whose material interests are in danger of being very seriously affected if navigation is not maintained, and the contractors for Barge canal work, who are under bond to do certain things within a specified period and in a specified manner

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and who, it would almost seem, in order to fulfill their contract obligations must needs encroach upon the rights of boatmen, forwarders and shippers engaged in actual transportation business.

The new canal does not include a towing-path, and since the contract work follows the line of the present canal for upwards of 200 miles, the destruction of the present towing-path is a part of the work contemplated by the plans. This is only one of many points which have called for energetic activity on the part of the Superintendent of Public Works, and oftentimes the problem has resolved itself almost into one of both eating and keeping the cake.

In the case of one or two contracts which were early awarded, it has been discovered that if the work were carried forward as the plans contemplated, feeders and other structures of the present canal would be destroyed and the further utility of the existing canals would be rendered ineffectual. In such cases the Superintendent has been obliged, and has not hesitated to give the explicit order — "Hitherto shalt thou come, but no further."

The difficulties of maintaining navigation on those portions of the canal to be improved will necessarily become greater as the work progresses, and it is thought to be not unlikely that some legislation will have to be had in order to complete the project of improvement without doing violence to important and far-reaching interests.

Already, since the inception of the work, there have been three Superintendents in charge. When the first contracts, namely Contracts Nos. 1, 2, 3, 4, 5 and 6, were advertised, Charles S. Boyd, of New York, was Superintendent of Public Works. Bids on these contracts were opened on the 15th, 16th and 17th of December, 1904, but before they were acted upon, the head of the Department was changed, N. V. V. Franchot, of Olean, becoming Superintendent of Public Works in January, 1905, under Governor Frank W. Higgins. The first contracts for Barge canal work to be awarded were Contracts Nos. 1 and 4, the awards being made by Superintendent Franchot in February, 1905. In addition to these contracts there were awarded during Superintendent Franchot's administration Contracts Nos. 7, 8, 10, 11, 15, 16, 17, 18, 19, 25, 27 and 34.

In January, 1907, Mr. Franchot was succeeded by the present Superintendent of Public Works, F. C. Stevens, of Attica. Thus far the awards of contracts made by Superintendent Stevens for Barge canal work have been as follows: Contracts Nos. 9, 12, 13,

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14, 26, 31, 35, 40, 41, 45, 46, 47, 55, 60, 61, 64, 66 and 68; also the contract for the work left uncompleted on Contract No. 17, after its abandonment by the former contractor. In the case of Contracts Nos. 9 and 64, two advertisements were found to be necessary in order to make possible their award; on the first lettings, no bids at all having been received for Contract No. 64, and but a single bid for Contract No. 9, which could not be accepted by the Superintendent of Public Works, as the proposal was greatly in excess of the Engineer's estimate. At the present writing Superintendent Stevens is advertising for bids on two additional contracts, namely, Nos. 20 and 38. Bids already have been asked by Superintendent Stevens on three different occasions for Contract No. 20, but none was received.

The present Deputy Superintendent of Public Works, Winslow M. Mead, of Rochester, has been in office since the inception of the work, and for some years previous, and up to the present time has opened and read all bids received for Barge canal work.

Comptroller.

One of the first essentials to the progress of the work is the raising of funds, and this duty devolves upon the Comptroller through the medium of the sale of bonds. In the preparation of the bonds, the paper is delivered to the Comptroller under a certified double count, the paper being of the size necessary for the bond and especially water-marked for that purpose. A sufficient number of sheets for the preparation of each issue of bonds is delivered to the engraver, who has the contract for that purpose, and a receipt from him for the paper is delivered to the Comptroller. Upon the completion of the bonds the paper is fully accounted for, either in actual bonds or in imperfect or blank sheets. After the bonds have been carefully examined and the signature and seal of the Comptroller affixed, they are delivered to the State's transfer office, The Manhattan Company, at 40 Wall street, New York city, for counter signature. The sale of the bonds is held after due advertisement in at least two papers published in the city of New York and the official paper in the city of Albany, and after the awards are made by the Comptroller to the successful bidder or bidders, a communication is forwarded to the Transfer Officer, who, upon the receipt of the funds, places them to the credit of the Treasurer of the State of New York, on account of the Canal Fund. Thereupon the full transaction

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OFFICE OF THE COMPTROLLER.

Scene at an opening of bids for the sale of bonds. At the center is the Comptroller, Martin H. Glynn; at his left, Patrick C. Dugan, Deputy Comptroller; next to the left, Wm. G. Shaible, head of the Bureau of Canal Affairs and Secretary to the Canal Board and also to the Commissioners of the Canal Fund.

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relative to the issue of bonds becomes complete — from the time the paper is made to the time the bonds are paid for.

The first issue of bonds, amounting to $2,000,000, due January 1, 1923, was sold on April 20, 1905, at a premium of 102.313 and accrued interest, or an aggregate premium of $43,260. The second issue, $1,000,000, due January 1, 1956, was sold June 14, 1906, at $101.13 and accrued interest, or a premium of $11,300. The third issue of bonds, amounting to $5,000,000, due January 1, 1957, was sold April 5, 1907, and was awarded at par and accrued interest, for the entire issue. The fourth issue, amounting to $5,000,000, due July 1, 1958, was sold September 26, 1908, at a premium of $102.89 and accrued interest, for each one hundred dollars thereof, or an aggregate premium of $14,445.90, so that there have been issued to date $13,000,000 of the $101,000,000 of canal bonds estimated to be necessary for the completion of the Barge canal. There have been expended up to and including September 30, 1908, $8,311,432.14. The distribution of these expenditures to the various canals was as follows: Erie canal, $5,525,494.17; Champlain canal, $2,396,065.46; Oswego canal, $389,872.51.

The duty devolves upon the Comptroller of auditing the accounts of all moneys expended for Barge canal purposes. These include the payments to contractors, payments for engineering expenses, payments for permanent appropriations of land and for damages thereto, the expenditures of the Advisory Board of Consulting Engineers and of the Special Examiner and Appraiser for the purchase of lands, and the various miscellaneous expenses incident to the work of constructing the canal.

During the fiscal year ending September 30, 1908, there have been expended for preliminary engineering, $536,859.85; for construction engineering, $205,930.34; for advertising for bids on contracts, $2,623.90; for recording appropriations of land, $193.43; for payments to contractors, $3,214,882.61; for miscellaneous expenditures of the Superintendent of Public Works, $26,566.55; for the payment of lands appropriated, $178,431.05; for damages to lands, $1,068.15; for the investigation of claims, witness fees, etc., $3,566.85; for salaries and expenditures of Advisory Board of Consulting Engineers, $41,403.13; for the Board of Special Examiners and Appraisers and for the Special Examiner and Appraiser who succeeded this Board, $16,653.13; for preparing Barge canal bonds, $4,426.89; for advertising the sale of Barge canal bonds, $328.50; for recording deeds of land taken, $74.82; for

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BUREAU OF CANAL AFFAIRS — COMPTROLLER'S OFFICE.

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clerical service in the Comptroller's office, $1,200, making a grand total of $4,234,209.20 of expenditures for the fiscal year. The distribution of expenditure is made to the various sections of the canals, consisting of eleven sections of the Erie canal, three sections of the Champlain canal and one section of the Oswego canal. Where any expenditures are created which cannot be identified with any particular section, they are apportioned to each section according to a percentage basis as prepared by the State Engineer. This percentage is based upon the proportionate estimated cost that each completed section of the canal will bear to the cost of the completed Barge canal, namely, what is known as the $101,000,000 estimate, which formed the basis of the appropriation in the original act.

Advances are made to the Division Engineers from time to time in amounts not to exceed $40,000, and surety company bonds are filed with the Comptroller to secure such advances. Abstracts of expenditures with the accompanying vouchers are presented monthly and no further advances are made until these vouchers are duly audited by the Comptroller. Accounts and vouchers are presented by the Superintendent of Public Works for miscellaneous expenditures, together with his draft for the amount thereof, and these drafts are paid from the treasury upon the warrant of the Comptroller. Monthly estimates are prepared by the Resident Engineers and approved by the Division Engineer, the State Engineer and the Advisory Board of Consulting Engineers, for the work of construction on each of the contracts, and drafts are issued by the Superintendent of Public Works on the Comptroller and payment of each draft is made by a Treasurer's check, issued on the warrant of the Comptroller, after due audit of each estimate by him.

There are two methods of payment for lands taken, one being through judgments of the Court of Claims, and the other through agreements entered into by the Special Examiner and Appraiser. These payments, as well as all other miscellaneous payments incident to the work of construction, are made upon the rendition of accounts and vouchers in due form, by the Treasurer's check, issued upon the warrant of the Comptroller.

Since the passage of the Barge Canal Act the Comptrollers have been: Nathan L. Miller, Otto Kelsey, William C. Wilson and Martin H. Glynn. The part of the Comptroller's department upon which canal work devolves is the Bureau of Canal Affairs. Of this bureau William G. Shaible is the head.

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Attorney-General.

The Attorney-General, by virtue of his office, is a member of the Canal Board, and is the official legal advisor of the members thereof. During the last two years the Attorney-General has taken an important part in the work involved in the Barge canal improvement. Many questions have arisen requiring his advice, in the letting of contracts and the construction of their terms, in the progress of the work and in the appropriations of lands and waters. The preliminary legal questions were fairly well settled before the present administration, but it was not until the present term that questions concerning the extent and nature of the State's liability for damages arose in the Court of Claims. That court is now almost exclusively engaged in disposing of Barge canal claims, and the conduct of the defense has placed a matter of great responsibility on the Attorney-General. Certain important cases have already been brought to trial and the court is going at length into the canal history of the state, to ascertain the State's rights in streams, both from the fact of their being originally navigable and also on account of the former appropriations of such waters for the canals. The rules for the valuing of water-power and as to what constitutes riparian rights, two questions involved in these cases, are of great importance, both theoretically and practically, to the engineer and to the lawyer. These questions have been at rest for a great many years, so far as the State is concerned, and whether they have been actually settled is in dispute. While the original canal construction provoked questions of this kind, which were passed upon by the courts, they may still be treated as open questions by our highest courts to-day.

During the time since the Barge Canal Law was passed the office of Attorney-General has been held by John Cunneen, of Buffalo, to December 31, 1904, by Julius M. Mayer, of New York city, 1905–1906, and by William S. Jackson, of Buffalo, whose term expires December 31, 1908.

The preparation of the Barge canal cases and of the cases before the Court of Claims and the trials thereof during the past two years have been managed by George P. Decker, Deputy Attorney-General.

State Civil Service Commission.

The relation that the State Civil Service Commission bears to the Barge canal work is that of seeing that the spirit of the merit system is carried out, by requiring that all appointments to that

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work shall be made according to the State civil service laws, rules and regulations. By these rules the positions in the Department of the State Engineer and Surveyor, including, of course, all positions under Barge canal supervision, are placed in one of three classes — the unclassified, the exempt or the competitive. Appointments to positions in the first two classes are made without examination. All appointments to positions in the competitive class, by far the largest class, are made only from lists of names certified by the State Civil Service Commission of those who have successfully passed a competitive examination for the position to be filled. By the law which regulates appointments, those persons whose names stand nearest to the top of all eligible lists have the best chance for appointment.

The following table gives the number of examinations held during the year 1908 for positions under the State Engineer, also the total number of candidates, the total number who passed and the total number appointed:

POSITIONS.	Number of examinations.	Total number of candidates.	Total number passed.	Number appointed from 1908 lists.	Number appointed in 1908 from 1907 lists.	Total number appointed.
Assistant civil engineer	2	163	86	45	23	68
Axeman	1	538	241	0	136	136
Bridge designer,	2	28	22	12	3	15
Bridge draftsman	3	23	15	3	1	4
Chainman	1	547	90	0	70	70
Civil engineering draftsman	3	235	76	36	12	48
Junior bridge draftsman	1	59	22	0	0	0
Leveler	3	208	96	52	15	67
Mechanical draftsman	1	29	8	3	0	3
Rodman	2	543	150	47	7	54
Tracer	1	141	45	9	6	15
Totals	20	2514	851	207	273	480

NOTE.— This table covers both the Barge canal and the Good Roads Departments.

In addition to those appointed by the State Engineer, several of the successful candidates in these examinations have been appointed by the State Architect, the State Water Supply Commission and the Public Service Commission.

One of the benefits resulting from the Civil Service Commission's power over appointments under the State Engineer has been the encouragement of promotion to meritorious appointees from lower to higher positions in the Department. This has been ac-

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complished by the rule that all persons on eligible lists who are already in the Department in the next lower grade shall be given preference in appointment over all other eligibles.

The State Civil Service Commission has another power, and a very important one, over all appointees in the State Engineer's Department, in common with those in all other departments and institutions of the State service, for no appointee in any State department can secure his salary until the State Civil Service Commission has certified to the State Comptroller the pay-roll containing that appointee's name. As at present constituted, this power is really the great bulwark of the entire State civil service system.

Special Examiner and Appraiser of Canal Lands.

Under a special act of the Legislature (chapter 335, Laws of 1904) the office of Special Examiners and Appraisers of lands for improved State canals was created, which provided for the appointment by the Governor of three men, to be designated Special Examiners and Appraisers. The duties of this Commission were to visit and inspect each parcel of land to be appropriated and to negotiate with the owners for an amicable settlement, if possible, and thus to dispense with the extra expense, both to the land owners and to the State, necessitated by chapter 147 of the laws of 1903, known as the Barge Canal Act, which provided that all of these claims should be settled in the Court of Claims.

After the service of papers for appropriating lands and structures and the filing of duplicate maps with the Appraisers, it became the duty of the Appraisers to visit the localities, to inspect and make proper examination of the land and also of any buildings which might be on the properties, to make careful note of their findings in books kept by them for the purpose, to make inquiries concerning the values of properties to be taken, and immediately to begin negotiations for their purchase. Sometimes this has been done while they were still on the ground, but in other cases agreements have been reached only after prolonged negotiations and frequent visits to the properties. As soon as an agreement was arrived at the Board, in behalf of the State, executed a contract with the property owner, which was submitted for approval to the Canal Board at its next meeting. If the Canal Board did not approve, the contract was returned to the Appraisers; if approved, the secretary of the Canal Board notified the

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property owner and requested that he forward a deed to the Attorney-General. After search had been made by his office and a satisfactory title proved, the fact was then certified to the Comptroller, who sent a check and the transaction was closed.

This is an arrangement which should appeal to everyone as a fair and just manner of treating people from whom homes and properties are taken against their will and inclination. The Appraisers, with no special interest in the neighborhood where they might go to carry on negotiations, could have only one purpose — to serve the best interests of the State and to deal fairly with the property owners. Thus they were more likely to secure better results and more speedy and satisfactory settlements with the people than by any possible process through the Court of Claims. Moreover, this court is already burdened with the business it has on hand, so that filed claims are often greatly delayed in being brought to trial on account of the large number of cases already on the books.

Of the Barge canal claims tried thus far, the judgments awarded by the Court of Claims compare favorably with the amounts offered by the Appraisers. In but few cases have the judgments exceeded the figures determined by the Appraisers.

There are now on file in the office several hundred maps covering appropriations on twenty-five contracts, and representing parcels of land which the Appraisers, in accordance with the rules, have visited and have on file specific data pertaining to them.

Contracts Nos. 1, 2, 3, 4, 6 and 11 have been practically closed up. On Contract No. 5, after maps were filed with the Appraisers and several agreements executed, the Canal Board directed them to discontinue making further agreements, owing to a possible change of line. The other contracts, covering appropriations inspected by the Appraisers, though more recently awarded, compare favorably with those awarded to contractors when the work of construction was first commenced.

The Board of Special Examiners and Appraisers continued in office for four years. The members of this Board were Harvey J. Donaldson, J. Edgar Leaycraft and George Bingham. Then chapter 335, under which they were created, was repealed by an act of the Legislature in April, 1908. By this act, chapter 195 of the laws of 1908, the Board was abolished and a single-headed commission, consisting of Harvey J. Donaldson, was created, known as Special Examiner and Appraiser of Canal Lands, appointed by the Governor, under whose direction the work of appraising has been continued with marked success.

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Frederick Skene,
State Engineer.

Irving J. Morris,
Chief Clerk.

Frank L. Getman,
Deputy State Engineer.

PRIVATE OFFICE OF THE STATE ENGINEER AND SURVEYOR.

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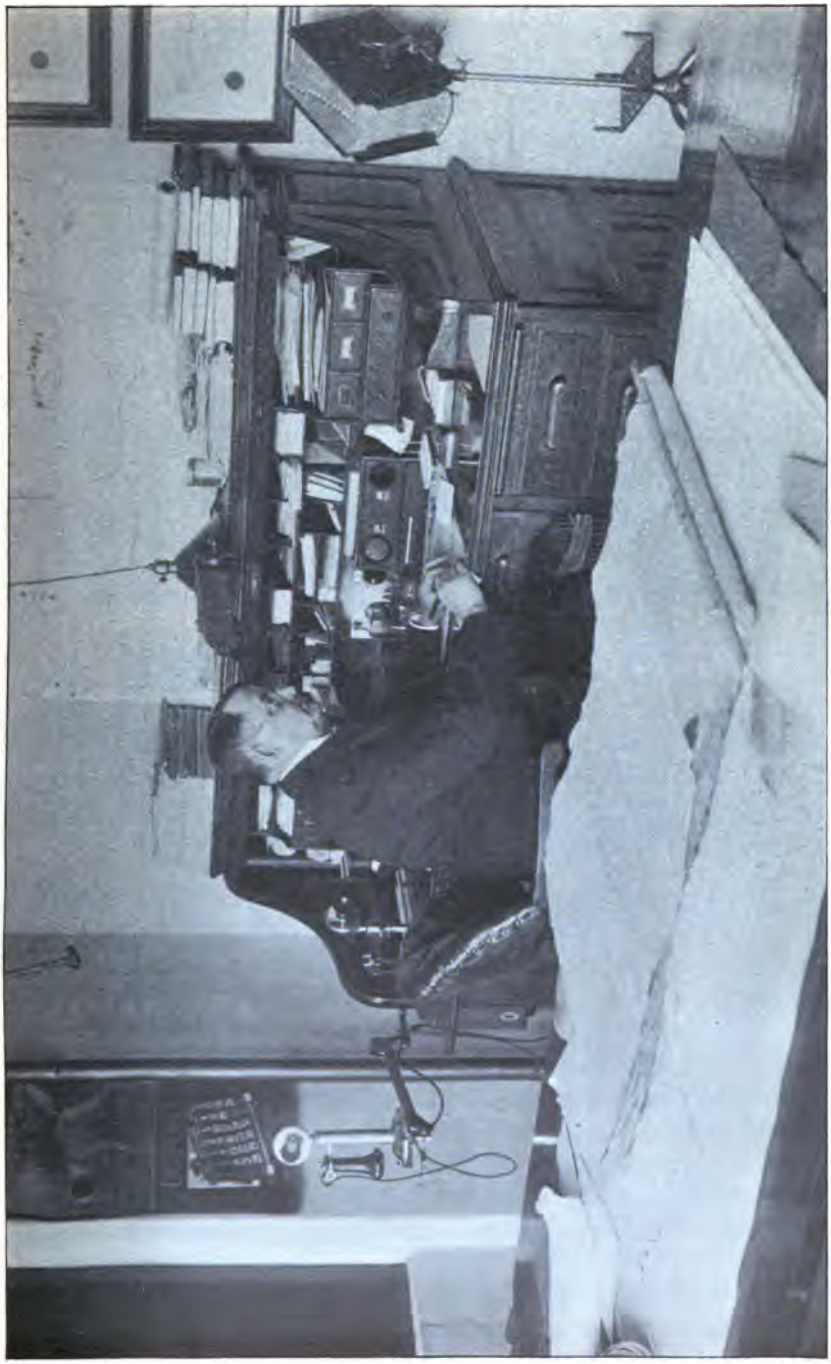

William R. Hill, Special Deputy State Engineer.

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State Engineer and Surveyor.

Upon the State Engineer and Surveyor rest the largest responsibilities for executing the will of the people as expressed in the passage of the Barge Canal Act, and carrying to an early and successful completion the undertaking thus authorized. As a member of the Canal Board, he has an important part in the chief governing body over the whole enterprise. To him was originally assigned the task of selecting the route of the canal, and to him now is given the duty of planning and determining the details of construction along that route, with slight permis-

Room of Special Resident Engineer — Special Deputy's Office.

sible deviations. He also prepares the estimates of cost, and directs and supervises the work of construction after contracts have been awarded. Upon the completion of any contract the State Engineer makes the final measurements and estimates for paying for its construction and, together with the Superintendent of Public Works, he accepts the finished work in behalf of the State.

For performing all of these duties the State Engineer must needs have a large corps of assistants and the Barge Canal Act particularly authorized certain of the more important helpers — a

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Room of Stenographer in charge, and private telephone exchange — Special Deputy's Office.

Stenographers' Room — Special Deputy's Office.

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Special Deputy and additional Resident Engineers. The Special Deputy is the direct head of Barge Canal work. In his office the work has been divided among several bureaus, and these will be severally discussed in the following pages.

Since the passage of the Barge Canal Act, those to occupy the office of State Engineer have been Edward A. Bond, Henry A. Van Alstyne, and Frederick Skene. The office of Special Deputy has been held by Henry C. Allen and William R. Hill.

Bureau of Designing and General Drafting.

When the organization for the design and construction of the the Barge canal was commenced, the work for a time was con-

Bureau of Designing and General Drafting, drafting room — Special Deputy's Office.

ducted by a single staff, covering the entire canal, but, as the enterprise progressed, it was found necessary to divide the work into organizations, which have come to be called by the name of Bureaus.

The original organization is now known as the Bureau of Designing and General Drafting. Before the size of operations made it necessary to form other branches, the work of preparing tracings to serve as guide maps for detailed surveys and contract drawings, studies for determining the slope between the Genesee and

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Niagara rivers, the examinations of alternative locations at Waterford, Fort Miller and elsewhere, the preparation of instruction books to govern the engineers in office and field work, the writing of specifications for all kinds of construction, except bridge superstructures, the gaging of streams, the obtaining of high-water records along the rivers and other preparatory work was carried on under this single bureau.

As the work increased the following branches have been developed from the main organization in substantially the following order: Bureau of Locks, Bureau of Rivers, Bureau of Water-

Branch for checking estimates, Bureau of Designing and General Drafting — Special Deputy's Office.

Supply, Bureau of Computing and Checking, Bureau of Hydraulics and Bureau of Electrical Equipment. The Bureau of Bridges, the Bureau of Publication and Reports and the Testing Bureau have been transferred from the general department of the State Engineer to the Barge canal office as the expediency therefor has arisen. Matters not properly belonging to one or the other of these bureaus is taken care of by the Bureau of Designing and General Drafting. This work has been divided into several branches, as follows: Time and pay-rolls; expense accounts; requisitions for purchases of office furniture and supplies; storage

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and filing of drawings and plans; specifications; cost data; printing of titles upon drawings; maps, specifications and correspondence, relative to all appropriations of lands for canal construction; checking of estimates for payments to contractors; preparation of plans for contracts not in rivers nor requiring locks; preparation of instructions for and inspection of the office work of the field offices; general supervision of construction over certain contracts, the plans for which were prepared in this bureau.

One branch of this bureau deserves a few words of description. When monthly estimates of contract work have been prepared in the field offices and forwarded to the Special Deputy, they are carefully checked, in order to eliminate all discoverable errors. This involves not only an examination of the quantities and rates per unit and the footings in dollars and cents, but includes also an inspection of the detailed computations, to eliminate errors in the computation of quantities. The detailed computations are examined with the idea that they should be clear and easily followed, as well as accurate, and that substantially the same system should be adopted in all of the contracts. When the contract work is completed, a final estimate must be rendered within sixty days, and this makes it necessary that all errors should be discovered as the work goes along, since an accumulation of errors in any one contract, or a lack of skill in the arranging of the accounts, might lead to very serious delays in the preparation of the final estimates. The monthly estimates must also be inspected carefully to see that all work performed has been duly authorized, either by the original contracts or by proper supplementary agreements.

Tables of comparisons between the preliminary and monthly estimates are made each month to the Special Deputy, showing him the two quantities, and if there is any marked difference between the estimates, his attention is called to the fact and proper explanations are secured from the resident engineers.

When the limits of a contract have been fixed and the plans are completed and ready for submission to the Advisory Board, a computation is made from the estimates of 1900 and 1903, upon which the appropriation of $101,000,000 was based, so as to determine the amount of appropriation available for constructing that particular contract. Since the completed canal must be built within the total appropriation, this method has been adopted of carefully comparing the preliminary estimates with the cost as based on construction plans, for it has been deemed necessary that

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as many as possible of the individual contracts should fall within the appropriation for the particular stretches of canal covered by those contracts.

Many tables and statements of various kinds, which do not fall properly within the scope of the other bureaus, are required from time to time by the Special Deputy, the secretary of the Advisory Board, or the editor of the *Barge Canal Bulletin,* and the preparation of these statements and tables, together with the work in relation to monthly estimate and the amounts available for individual contracts, are assigned to this branch of the general drafting bureau, in charge of Clark Brown.

Bureau of Locks, drafting room — Special Deputy's Office.

Bureau of Locks.

In the Bureau of Locks, in charge of G. F. Stickney, Supervising Engineer, there have originated plans for much general work in addition to those distinctively relating to locks. Plans have been prepared for nineteen contracts, extending over 154.55 miles of canal. Sixteen of these, covering 126.74 miles, have been placel under construction and call for the expenditure of $17,827,513. Plans for three contracts, aggregating 27.81 miles, estimated to amount to a total of $4,126,054, are ready to be submitted to the Advisory

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Board, and plans for two additional contracts, extending over 28.5 miles, which will cost approximately $6,300,000, are in various stages of completion. These plans contain designs for some 195 major structures, which, with the exception of lock-gates, bridge superstructures and a few bridge abutments, have been prepared by this bureau. These include 22 large locks, one small junction lock, 17 fixed dams, 2 movable dams, 8 spillways, 17 culverts, 8 sets of head-gates, 3 power plants, 46 retaining walls, 14 crib docks, 6 pile docks, 25 complete bridges and the abutments for 26 bridges. The locks vary in lift from a minimum of 6 feet to a maximum of 34½ feet, and the combined lift of the 22 large locks is 394.65 feet. The nineteen contracts, for which plans have been completed, require the excavation of 43,015,626 cubic yards of earth, rock and other materials, and the construction of 942,543 cubic yards of concrete masonry. Numerous supplementary plans have been prepared to provide for the changes made necessary by the contingencies incident to construction.

The preparation of these plans has required a vast amount of study of the physical features of the country to be traversed by the Barge canal. Many problems had to be solved before the plans were commenced. These included the disposal of flood waters in the rivers and streams, so as to accommodate the maximum flow without injury to the canal itself or to adjacent property, the determination of the best types of structures to accommodate navigation and to provide means for maintenance and control, and many questions concerning methods of construction best suited to each particular locality.

Bureau of Rivers.

The bureau having charge of the principal portion of the work on the Hudson, Mohawk, Genesee and Oswego rivers is known as the Bureau of Rivers, and has been in charge of D. A. Watt, Supervising Engineer, its present head, since its organization. Prior to the final adoption of plans for the work, the head of the bureau was commissioned to visit the chief waterways in Europe and to investigate methods of construction and operation, and upon his return he recommended the use, among other things, of the bridge type of movable dam, which has been adopted and will be used for all new dams between Schenectady and St. Johnsville on the Mohawk river, and at Rochester on the Genesee river. Each dam consists of two or more spans of an overhead bridge, supporting hinged uprights upon which roll up or down the gates holding

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back the water. The bed of the river between the piers is provided with a wide sill of concrete in which are set the cast-iron shoes supporting the lower ends of the uprights when the dam is closed against the passage of water. A general description and illustrations of the type was given in the *Bulletin* for April.

The design of certain other dams and locks, where this class of dam is not required, and the general dredging plans of the rivers previously mentioned, is also entrusted to this bureau, as well as the work at Little Falls, where the highest lift lock in the world will be constructed, and the work at Lockport, where the only

Bureau of Rivers, drafting room — Special Deputy's Office.

combined lock along the Barge canal is to be built. At Lockport there are at present five locks; these will be replaced by the two just mentioned.

Although the work, as finally developed, differs from the kind of construction planned in the original 1900 scheme — in substituting movable for fixed dams of the rock-filled, timber-crib type, and in using locks forty-five feet wide in place of locks of twenty-eight feet width — it is expected that the construction will be accomplished without exceeding the estimates for the earlier types of construction. The saving of money, however, was not the principal consideration, but rather the purpose to obtain a construction which should best meet present and future conditions.

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Plans for two storage reservoirs, one at Delta, near Rome, and the other at Hinckley, near Trenton Falls, prepared in the Syracuse office by A. D. Sanderson, are also under the supervision of this bureau. These reservoirs are designed to collect and store the waters of the Mohawk river and of West Canada creek, so as to provide water for the Rome Summit level. The capacity of these reservoirs is so great that they are expected to have a beneficial effect upon the floods of the Mohawk valley.

Bureau of Bridges.

Prior to 1899 the plans for State bridges were generally prepared by the engineering departments of some bridge company,

Bureau of Bridges, draftiug room — Special Deputy's Office.

and subsequently these bridge companies would submit bids for the bridges they designed. In 1899, upon the initiative of the State Engineer, a law was enacted providing for the appointment of a Chief Bridge Designer, thus starting the present Bureau of Bridges. From its beginning William R. Davis has been Chief Bridge Designer; there are now also an Assistant Chief Bridge Designer and about forty subordinates.

In January, 1904, the bureau was transferred to the Barge canal office. Since then at least ninety-five per cent of the work of the

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bureau has been in connection with the Barge canal. Plans have been prepared for highway bridge superstructures, bridge substructures, movable dams, lock-gates, needle-dams, lock-valves, guard-gates and other miscellaneous work. A new type of highway bridge abutment has been originated by this bureau which will save the State many thousands of dollars. Plans have been prepared for a notable concrete arch aqueduct at Medina, which will have a span of 285 feet and will be more fully described in a later issue of the *Bulletin*.

This bureau also has charge of the mill and shop inspection of all metal work in connection with Barge canal and other structures. The steel shapes for bridge superstructures are rolled at several of the principal steel mills of the United States and are manufactured into trusses, floor beams, etc., at the shops of the various bridge companies. On account of the large attendant expense it has proved impracticable to date for the State to have men in its employ located at the mills and shops for the purpose of making the necessary inspection required by the specifications on amounts of material comparatively so small. Such inspection, therefore, has been regularly made by a firm of inspecting engineers, appointed by the State Engineer. These engineers are able to make the inspection at a low cost, because their representatives inspect large quantities of material for other clients in connection with the materials inspected for the State. Reports of such inspections are regularly received and upon receipt are carefully examined in detail and placed on file.

Shop drawings of all structural steel and machinery for new city bridges and other structures are submitted by the contractors for approval before any shop work is done. These drawings are carefully examined and are approved after having been corrected to conform with the requirements of the contract drawings and specifications.

The bureau also examines and passes upon plans and estimates submitted by railroad companies for many new railroad bridges over the Barge canal.

Bureau of Hydraulics.

This bureau is charged with the duty of investigating the special hydraulic problems arising in connection with the Barge canal work.

In general the canal follows the valleys of natural streams, but it will change the low-water levels, the flood stages and other

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hydrological features of many of the streams and rivers. Thus the relation between the canal and the streams along its course becomes very intricate. The canal runs parallel to streams in some places, intercepting their tributaries; in some places streams are crossed in pools above dams, as for example the Genesee river crossing at Rochester; in other places the canal enters the river channels and follows along the course of the stream, as in the case of the Oswego, Oneida, Seneca and Mohawk rivers. These mutual relations between the canal and the adjacent water courses have given rise to several questions, such as the determination of water

Bureau of Hydraulics — Special Deputy's Office.

slopes, the effect of dams and backwater, the yield of proposed reservoirs and feeders, and other similar matters, that are of quite unusual scope and magnitude.

Many of these questions had to be thoroughly worked out before the preparation of plans could be undertaken, and this work has been done largely by the Bureau of Hydraulics, of which Robert E. Horton is Resident Engineer in charge. In the study of these problems, some of which are very complex, a number of new methods of treatment have been developed, which will be of value in similar hydraulic work elsewhere; among these may be mentioned a means of determining the regulation of floods afforded by a reservoir, a method for slope and backwater calcula-

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tions in variable channels, special solutions of submerged weir problems, etc. In the preparation of the plans, such details as the determination of the low-navigable and high-navigable stages, the size of spillways, the supply available from the proposed storage reservoirs and canal feeders, etc., are based largely upon the recorded stages, the fluctuations in level and the gagings of discharge of the streams in question. In order to obtain requisite data of this character about 100 gages are maintained throughout the state, on which readings are taken usually twice each day. In addition, measurements or records of discharge are obtained at the more important of these stations. This feature of the Barge canal work is looked after by the Bureau of Hydraulics and the results of these gagings, which are often of value to Barge canal contractors in protecting themselves against floods and to water-power and water-supply interests in general, are published annually in the State Engineer's report.

The modifications in streams and water-levels along the line of the canal affects vested interests, notably water-powers at State dams, and to some extent, also, the low-lying farm lands, by reason of changes in ground-water level. In order to determine the extent of the changes produced by the construction of the canal, it is necessary that continuous records shall be kept, showing the hydraulic conditions both before and after the canal is constructed. The maintenance of gaging records, the records of rainfall and ground-water level for this purpose, and the utilization of the data in cases coming before the State Court of Claims, involving hydraulic features, is a part of the work of this bureau.

Bureau of Computing and Checking.

The work of the Bureau of Computing and Checking is twofold; first to aid in the design of structures by determining the economic sections of walls as required for stability, and second to determine from the finished plans the quantities and cost of all materials required for the work. The Bureau is in charge of F. M. Eames.

It will be accepted without proof that a wall must be of such weight and design that it will withstand with a margin of safety any and all pressures that may ever act against it, and a moment's thought will make it evident too that it is also highly important from the standpoint of economy that its cross-section be no greater than necessary. In the design of a high wall, a step one foot wide

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and three feet thick seems a small matter comparatively, but in a lock wall three hundred feet long it means 900 cubic feet of concrete worth, at $7, per cubic yard, $233. In determining the stability of a lock wall we must study the resultant pressure under all the varying conditions that may take place, with lock empty or full of water, with backing dry or saturated, and, if on piles, the upward pressure must be considered. In studying the stability of the thrust-wall of a lock — the portion where the gates are located — the work is quite complicated, the wall contains large voids for culverts, etc., and the thrust of the gates must be considered. When designing a pile foundation, the location of each pile must be determined.

Bureau of Computing and Checking — Special Deputy's Office.

Section 6 of the Barge Canal Law requires that the engineer "shall ascertain with all practicable accuracy the quantity of embankment, excavation and masonry, the quantity and quality of all materials to be used and all other items of work to be placed under contract and make a detailed estimate of the cost of the same." Largely to the Bureau of Computing and Checking is assigned the duty of carrying out this particular feature of the law. The bureau is furnished with blue-prints of the plans made in the designing room and with prices determined by the super-

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vising engineer and is required carefully to prepare, with diagrams and computations, a detailed statement of the quantities of each material required, in such form that the engineer in the field may at any time easily follow the computations or the advisory engineers quickly determine the cost of any structure or of any proposed alteration. These computations become the basis of monthly and final estimates, by which the contractor is paid. All of these estimate sheets are finished in india ink and are carefully preserved in the Barge canal office, blue-print copies being sent to the engineers in charge of the construction. In order to eliminate errors, all computations are checked independently by two in addition to the original computer. To make the computations of a single lock requires the work of three men for upwards of a week.

Bureau of Electrical Equipment.

It is intended to operate the movable dams and the gates, culverts and sluice valves and capstans at the locks by electric motors, also to illuminate the locks and approaches by electric lamps.

Electrical engineering is closely allied to the other principal branches of engineering, but it is also a branch which is highly specialized. For this reason it was thought best to place the planning and estimating of all electrical equipment in charge of one of the resident engineers, George F. Chism, whose previous experience had particularly fitted him for the place. The studies that have been made by the Bureau of Electrical Equipment were described in the July issue of the *Bulletin*.

The work that is being done by this bureau is entirely preliminary, for no actual construction, or installation has yet been made. The investigations have been extensive and cover the field — from plans of central generating plants, with long-distance transmission and substation distribution, to plans for isolated generating plants at each lock.

No formal set of plans have as yet been prepared, since improvements in electrical machinery are so rapid and revolutionary that what may be an adequate and economic equipment now may be antiquated or less efficient than types prevalent at a date when the canal or portions of it are ready for operation. Several locks which may early be put into use are, however, approaching completion, and plans will no doubt be prepared during the next few months for the electrical equipment of such locks next spring.

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Testing Bureau.

In the Department of the State Engineer, there has been for many years a laboratory for the testing of cement. In the past the work of this laboratory has been mainly that of routine examination of the cement proposed for use on State works, varied occasionally by an effort to make investigation. The amount and breadth of this work has, however, been greatly increased and now the laboratory has an outfit and carries on work that is of very great value to the State, and has gained a reputation for value and worth that is in keeping with the greatness of the works which it protects by its inspection and examination of materials. The construction by the State of the Barge canal, the improvement of its public highways on so large a scale and the prospective erection of so many new State buildings, have given reasons why a well-equipped and carefully-conducted laboratory is a necessity, and with it a corps of careful and conscientious operators.

An increase in size and a thoroughness of equipment has been accomplished in the laboratory during the administration of the present State Engineer, in which he feels a just pride. The testing bureau is in charge of Russell S. Greenman, Resident Engineer.

While the laboratory has been commonly called, "The Cement Testing Laboratory," the testing of the cement is now augmented by further examinations and tests — one of these being a careful examination of the sands which may be proposed for use on State work, and another being complete tests of stone that may be proposed for use in the construction of the improved highways. Because of this broadening out, the title of the laboratory now is: "The Testing Laboratory of the Department of the State Engineer and Surveyor of New York."

In order to get the best apparatus and to be able to adopt the most accurate and up-to-date methods of testing and to secure thereby accurate and thoroughly reliable results, the engineer in charge of the laboratory has made trips of inspection to many of the best-known laboratories of various interests — such as manufacturers, national and municipal government, educational, corporate and private. In nearly all of these some new and good idea was obtained. In planning for and fitting up the new laboratory great care was taken to use the information received so as to give the best equipment without having unnecessary appliances and without making some of the mistakes of other laboratories.

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CEMENT TESTING.

Because of the fact that this laboratory tests cement for three branches of State work — the Barge canal, the improvement of public highways and the erection of new State buildings — the greatest amount of work is the testing of hydraulic cements. For the fiscal year ended September 30, 1908, there were tested for use on the Barge canal, 524 lots of a total 9,575 samples representing 324,910 barrels of cement. This cement represented fifteen brands of Portland cement. For making physical tests there are now complete working outfits for eight operators and four assistants. Each operator has his own special apparatus. The chemical laboratory is small but contains all that can be desired or is needed for making analyses or obtaining the specific gravity of cement and sands.

Methods of selecting samples for inspection vary considerably, but this department believes that the method in vogue in its laboratory gives the most satisfactory results. Because of the very large number of brands of cement tested (over sixty brands having been tested in this laboratory in the past eight years) it would be impracticable to adopt a form of general mill-inspection, although this is the best method now in common practise among the larger users of cement and is followed by this Department in some instances. When a contractor has had delivered upon his work at any time cement which he may propose to use in that work, it is the usual custom to have a representative of the Department take one sample from every ten barrels, or the equivalent of every tenth barrel when delivered in bags or sacks. The samples are properly marked for identification and immediately sent by express to this laboratory. Here separate tests for strength of each sample are made, but the other tests are made from a blend of all the samples in each lot, unless developements in the tests warrant closer inspection. The advantages of this method are that there can be no doubt of the cement proposed for use being tested and the testing of the separate samples gives a good probability of the uniformity of that entire lot of cement. Blended samples can give only the average results. Undoubtedly more bad cement has been detected by this method in our laboratory than would ever have been possible by any other means.

When the number of shipments from any cement mill to the Barge canal work warrants an inspector at the mill, the Department follows the general plan of mill-inspection. The cement com-

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pany sets aside certain bins of cement to be reserved for use on some particular Barge canal contract. The inspector takes samples from various parts of the bin. These samples are kept and tested separately, so as to secure the general quality of the cement. When the samples are taken, the bin is placed under the seal of this Department and then, if the tests show the cement to meet the requirements, shipments are made from the bin under the direction of the inspector. The cars are sealed by the inspector and when the cars reach the work the seal is broken by the engineer in charge of the work. By this method nothing but accepted cement is delivered upon the work.

The tests given each lot consist of those for length of time of acquiring a set, constancy of volume (or soundness), fineness of grinding and tensile strength. When poor results are obtained in any of these physical tests, they are supplemented by a test for specific gravity and by analysis. The physical tests are made to secure the quality of the cement and the others are for the purpose of ascertaining a reason why it may have given the results obtained. The method used follows closely that recommended by the American Society of Civil Engineers and the specifications under which the cement is submitted follow those recommended by the American Society for Testing Materials, except in some small matters of detail.

During the past eight years the standard of the specifications has been raised several times and now they are strict enough to insure good cement for use on all work of the State. The experience of the Department has been that, as the importance of the work has been increased, so has the need for greater protection and care in regard to its cement.

SAND TESTING.

The custom of testing cement has become so well established that it is now taken for granted in connection with all large works, but it is not so with sand. The blame for many a failure of concrete or mortar has been placed upon the cement, when the sand used was largely at fault. Proper attention, however, is now being given to the sand proposed for use. In this Department the question of sand examination has recently been given very careful consideration.

The sand is tested for percentage of voids and of loam, also for the amount of coarse pebbles, or grains there may be in it.

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These tests are made with large glass cylinders, which have been found to answer the purpose required very well. For testing the variation in size of the grains of sand a nest of sieves is used, these sieves having been carefully rated. The sands are also examined under the microscope for the minerals composing the sand. In addition, tests are made with cement for the tensile strength of the sand and cement. For this test the sand is taken in its natural condition and also after being thoroughly washed. The results are easily compared, for a "Standard" brand of cement is always used. This standard is made by blending together equal parts of several brands of cement which have shown uniform and similar results in the tests of the cement; thus this is actually a test of the action of sand with cement.

It should be stated that the work of this laboratory has not been confined to the regular and standard tests, but an endeavor has been made to keep pace with such tests as have been under discussion as applying to some practical condition found in construction. For example: Special series of tests for results of freezing mortar and the use of salt in solution, of use of screenings as compared with sand, of different sands with the same and different cements, of permissible amount of loam in sand, etc. These investigations have all been for the aid of the Department in its efforts to procure the best work.

Stone, gravel and crushed screenings are also examined before their use is permitted. In the examination of stone the qualities of toughness and hardness are obtained by means of the apparatus recently installed for the purpose of testing stone to be used on public highways.

After the careful inspection and testing of the materials that are proposed to be used on the Barge canal, the results obtained are reported to the Special Deputy State Engineer and he accepts or rejects, as the results show the materials to meet, or fail to meet the requirements of the specifications.

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Brief Account of Contract Work for November.

The following pages show what has been done during the month on the several contracts now in force on the Barge canal. The Erie canal contracts are described in order from Waterford west to Buffalo, and the Champlain and Oswego canal contracts follow, in order from south to north.

Erie Canal.

Contract No. 2.— For prism excavation and construction from Mohawk river at Waterford, including Locks 2 and 3, west, to a point about one-fourth mile west of the latter.

Excavation to a small amount only was done during the month. Concrete was laid in the following locations: In the north wall of Lock No. 2, 3,297 cu. yds., completing the wall. In the lower approaches and floor of Lock No. 3, 657 cu. yds. The concrete plant closed for the season Nov. 30th.

At Saratoga avenue the temporary wooden trestle over the prism has been removed. The curbing, paving and sidewalks of the bridge have been completed.

Contract No. 34.— For steel highway bridge over Erie canal at Waterford.

The small amount of painting necessary to complete this bridge has not yet been done.

Contract No. 11.— For prism excavation, and construction from Contract No. 2 to Mohawk river below Crescent, including Locks 4, 5 and 6, highway bridge abutments, guard-gate masonry, etc.

The steam-shovel has removed about 9,100 cu. yds. from the site of Lock No. 4, which has been placed in embankment in the rear of core-walls and north wall. About 300 cu. yds. were removed at the north core-wall, which completes the excavation for this wall. About 1,000 cu. yds. remain to complete the excavation at Lock No. 4. The other steam-shovel has removed about 5,800 cu. yds. from the rock cut near the western end of the contract.

Concrete was placed in the following locations at Lock No. 4: 6,600 cu. yds. in north wall, 730 cu. yds. in north core-wall, and 150 cu. yds. in south wing-wall.

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Contract No. 7.— For twelve steel highway bridges at various points on Contracts Nos. 2, 3, 4, 5 and 6.

At Lee Road bridge, on Contract No. 6, the steel superstructure is all assembled and bolted and 65 per cent riveted.

Contract No. 16.— For eleven steel highway bridges, ten of which are at various points on Contracts Nos. 25 and 27, Champlain canal, and the remaining one on Contract No. 11, Erie canal. In order to facilitate the progress of prism excavation on Contracts Nos. 25 and 27, the bridges on these contracts will not be built until next season, except the one at Dunhams basin, where about two-thirds of the steel is in place and bolted. All material is delivered and the bridge will be in place and riveting will begin within a few days.

Contract No. 14.— For work from Contract No. 11 to a point near Rexford Flats aqueduct, including Lock No. 7 and Dams Nos. 2 and 3; also for constructing Locks Nos. 13, 14 and 15, Dams Nos. 9, 10 and 11, Mindenville retaining dam, etc.

At Dam No. 2, Crescent, from the west end of dam "A" about 4,400 cu. yds. of material have been excavated and temporarily spoiled above the upper coffer-dam. Three hundred cu. yds. of first class and more than a thousand cu. yds. of second class concrete have been placed in the dam. In general work, the building of a trestle at abutment "B," moving of derricks and shovel, operation of stone quarry and crusher and hauling of supplies have occupied the month. The road work at Crescent is practically complete. About 5,370 cu. yds. of excavation from borrow pits and about 5,490 cu. yds. of embankment have comprised the month's work.

At Dam No. 3, Lock No. 7, Vischer's Ferry, unloading supplies and lumber for cribs, operating machine shop and power plant and general repairs have been in progress. Of excavation, 100 cu. yds. have been removed from the lower end of the lock and in cleaning up for the floor and land wall. Of concrete, about 1,750 cu. yds. of second class have been laid in the floor anl lock land wall foundation; and in dam "D" and abutment about 1,690 cu. yds. of first class and 4,700 cu. yds. of second class have been laid. Some 3,600 lbs. of metal have been placed in the lock and dam, and 9,000 ft. B. M. of timber cribbing have also been placed in the upper approach.

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At Dam No. 9, Lock No. 13, Yosts, in the land wall of the lock 2,030 cu. yds. of concrete have been placed, and 2,778 cu. yds. of gravel and sand excavated from the lower end. In connection with the work at this point it is of interest to note the excavation of a layer of river gravel and sand comprising the bottom half of the lock excavation. This is carried directly to a washer, thence by bucket conveyers and belts to the concrete mixer and thence back to the wall in the form of concrete, the gravel making this circuit within half an hour . When the plant is working properly the gravel hardly loses its motion from the time it enters the excavator until it reaches its final resting place in the masonry. The amount of sand obtained is too small to use all the gravel the excess of which is placed in the stock pile for future use.

At Dam No. 10, Lock No. 14, Canajoharie, work began November 5, and 2,500 cu. yds. of excavation have been taken from the lock site and deposited on the adjacent highway.

At Dam No. 11, Lock No. 15, Fort Plain, the excavation of 1,892 cu. yds. of material from the lock site and the placing of 2,756 cu. yds. of concrete comprise the principal part of the contract work for the month. Six sections of the river wall, which were started last month, the last two sections of the upper approach-wall, one section of the upper needle-beam wall, and the lower miter and needle-beam sills have been completed. Two sections at the down-stream end of the river wall have been started. No work has been done on the north side of the river since November 12, at which time a small rise in the river flooded the work.

At Mindenville retaining dam, on the whole, little progress has been here made during the month. The northerly end of the dam is now completed, except the placing of the heavy riprap in the apron next to the abutment, which cannot be done until the removal of the coffer-dam. All the removable false work and the derrick have been taken from the dam. The excavation for and placing of the bank protection at the south side of the river have been started.

Contract No. 8.— For constructing Dam No. 4 and Lock No. 8, at Scotia; Dam No. 5 and Lock No. 9, at Rotterdam; Dam No. 6 and Lock No. 10, at Cranesville, all on the Mohawk river.

At Dam No. 4, Lock No. 8, Scotia, excavation with steam-shovel and trains from the lock site was about 11,000 cu. yds.; with orange-peel bucket, derrick, trains and teams, at the south

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end of the dam, about 1,800 cu. yds. In general work reinforcing the coffer-dam at the north end of the dam, pumping from same, erecting buildings for pump and shop and hauling supplies, has been in progress.

At Dam No. 5, Lock No. 9, Rotterdam, in general work, washing and screening sand and gravel, hauling supplies, moving and dismantling derricks and pile-driver on the north shore, and building guy derrick at the south abutment, have occupied the month. The steam-shovel at the upper guide-wall has excavated 3,330 cu. yds. Behind this wall, 1,150 cu. yds. of embankment have been placed. For the river wall and floor of lock, 723 twenty-five-foot piles have been driven. In the lock floor and land wall 1,260 cu. yds. of concrete have been placed, with nearly six tons of metal work.

At Dam No. 6, Lock No. 10, Cranesville, the steel sheet-piling has been straightened, the coffer-dam has been pumped and sand and gravel have been washed and screened. Excavation for the south end of the dam was 580 cu. yds.; from borrow-pit on the north shore, 1,760 cu. yds., used as embankment, at the north shore protection. In the south pier and south end of the dam 1,810 cu. yds. of concrete have been laid, and nearly twelve tons of metal work has been placed in the lock and dam. At the south end of the dam 348 short piles have been driven. Nearly 600 cu. yds. of dry stone work on the north shore, and upwards of 100 cu. yds. of riprap at the south end of the dam have been placed. Two needle-beams and four lock-valves are complete.

Contract No. 17.— For constructing Dam No. 7 and Lock No. 11 at Amsterdam, and Dam No. 8 and Lock No. 12, at Tribes Hill.

At Dam No. 7, Lock No. 11, Amsterdam, excavation for the floor and for riprap above and below the south span of the dam and for the river wall of lock is completed; excavation for the lower sill and cut-off wall well advanced; concrete for the land wall of lock completed, except cut-off; one-third of the river wall completed to grade; balance of wall within ten feet of grade, except one block, of which only the footing is laid. Two blocks have been constructed, completing the south span of the dam, and south pier has been carried partly up. Riprap above and below the south span of the dam is practically completed and a small amount of riprap laid on bank protection.

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At Dam No. 8, Lock No. 12, Tribes Hill; excavation for the south span of the dam and for the pier is practically completed, except a small section on the down-stream side of the dam for riprap; excavation for the pier is done, with sheeting. Concrete for two blocks of the floor has been placed. Sheet and round piles for the south span of the dam have been driven. Ballast at the toe of the dam and under riprap has been advanced. Embankment and puddle-wall back of the south abutment is half completed and riprap above and below the dam about one-third completed. The stone was obtained from a site on the north side of the river.

In general, weather and river conditions have been very favorable for progress. A small amount of concrete and riprap remains to be done at Amsterdam before closing down for the winter. A small amount of concrete in the pier and dam foundation and a considerable amount of riprap remains to be done at Tribes Hill. Provisions for heating sand and stone for concrete have been made at both places.

Contract No. 18.— For excavating prism, Mindenville to Castle creek; constructing Lock No. 16, dam at Castle creek and incidental structures.

The dipper-dredge on prism cut during part of the time has excavated back of the tow-path for embankment to maintain the old canal pool, removing the old tow-path during remainder of time.

At Castle creek retaining dam excavation and back-fill and concrete dam are completed and the plant has been removed.

At Lock No. 16 both excavation and embankment have progressed at various points. The concrete lower miter-sill and needle-sill walls are complete.

Contract No. 31.— For improving the Erie canal at Little Falls, constructing Lock No. 17, and modifying the dam and constructing guard-gates at Rocky Rift.

About 2,000 cu. yds. of excavation have been removed during the month at Little Falls. More rock ledges have been stripped, some have been drilled, and preparatory work has been in progress. Several derricks have been placed and rock has been stored for crushing. The timber crib at the west end has been built, but the feeder openings are not closed. At the southern end a protective dike, 125 ft. in length, has been built across the low

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ground. The construction railroad is now in use for 1,800 ft. from the lock-site west to the spoil bank.

Contract No. 4.— For excavating prism from Oneida lake to a point about four miles east; constructing bridge foundations, stream entrances, crib and pile docking, breakwater and guard-pier in Oneida lake, etc.

The dredges have all been laid up for repairs and no dredging has been done during the month. The sinking of breakwater cribs has been completed, and the force is now at work sinking cribs for docking in front of Forest Home hotel, Sylvan Beach. The work of constructing a crib dam at Drum creek entrance is progressing and will be continued during the winter. The new north abutments at Burdick's and Robert's roads have been completed.

Contract No. 12.— For excavating prism between Oneida lake and Mosquito Point bridge on Seneca river; constructing Lock No. 23 and other structures.

The ladder-dredge *Cyclone,* located at the lower end of Oneida lake, has moved about 22,000 cu. yds. The ladder-dredge *Tornado,* located in the first cut-off west of Brewerton, was started on the 13th, has been adjusted, and has moved 6,400 cu. yds. The steam-shovel has been moved from the Brewerton cut to a point some three-quarters of a mile west, and is not working. It has moved 20,200 cu. yds. The hydraulic dredge *Geyser* has also been at work near this point and has moved 114,800 cu. yds., some of which has been very hard. Still further west the Page bucket excavator has been at work, moving 12,400 cu. yds. from the prism and building about 500 lin. ft. of back dike.

The concrete substructures for the two bridges, one of which is at Oak Orchard and the other a half mile west of Brewerton, are complete. The Oak Orchard bridge has been erected, partly painted and most of the flooring laid. Embankment for the south approach is nearly all in place.

The steam-shovel at the State ditch, not being able to do much below water-level of the Seneca river, has moved across the old ditch and has taken out this month 32,200 cu. yds.

Contract No. 45.— For the construction of a dam in the Oneida river at Caughdenoy and of Lock No. 24 and appertaining structures at Baldwinsville.

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Seven hundred feet of the prism excavation is about complete. The steam-shovel has stopped work until the superstructure of Syracuse street bridge is in place.

Foundation for the lower approach-wall to Lock No. 24 is in place and also that of about 100 lin. ft. for the retaining wall north of the lock.

The south abutment to the Syracuse street bridge has been completed and the laying of concrete in the lower approach-wall to Lock No. 24 is in progress.

At Caughdenoy dam 350 cu. yds. have been excavated for the foundation and some embankment has been placed on the dike near the old river lock, and back of the dam. In concrete, the south wing-wall, 250 lin. ft. of the apron and spillway adjacent is complete, also 40 lin. ft. of the apron and spillway adjacent to the north wing wall. Third and fourth class riprap has been placed below the apron where complete.

Contract No. 5.— For prism excavation, construction of Owasco creek entrance, bridge foundations at Mosquito Point, Sibley's and Fox Ridge highway crossings, etc. No contract work done during the month.

Contract No. 6.— For prism excavation, and construction of five bridge foundations between a point just south of Buffalo road and another point near South Greece and southwest of Rochester.

The steam-shovel and car plant, and the bridge conveyer which has been taking out the center cut further west, have both made fair progress. The channelers have followed the bridge conveyer as usual.

At Lyell Roard bridge the west abutment is finished and the east abutment partly built.

At the B. L. & R. railroad bridge the company has partly built the west abutment. The rock in front of this has been partly drilled and blasted. Excavation during the month amounted to 30,889 cu. yds.

Contract No. 60.— For prism excavation, and construction of culverts, bridge structures, etc., between a point 1.75 miles east of South Greece and a point 0.5 mile west of Adam's Basin bridge.

At South Greece cut-off the steam-shovel and train, working two shifts since the 9th, have excavated about 35,000 cu. yds. of

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earth and placed it either in embankment or spoil area. About one-half the earth cut has been made. One steam-drill has been working all the month and a channeler started on the 13th. Channeling on the north side near bridge No. 94 is practically completed and the channeler is now working on the south cut. Two borrow-pits have been opened, one on the Brown place just east of bridge No. 101 and the other at Crowell's, near bridge No. 100. The material is used for embankment.

On structures progress has been made as follows: Culvert No. 44 — Concrete head wall, wings, arch at south end and part of arch at north end are laid. Culvert No. 45 — The extension of the north end and the south end, except cut-off wall, are finished. Culvert No. 48 — Excavation has been made for the south end. Culvert No. 49 — The extensions of both ends, except cut-off walls, are finished. Culverts Nos. 50 and 51 — Excavation for pavement at the south end is started. Culvert No. 52 — Concrete foundation is finished and forms erected at the north end. Excavating at the south end is in progress. Culvert No. 53 — The south extension is finished, except paving. Bridge No. 94 — Excavation is finished, piers at the south end are built and forms for the north abutment erected. Bridge No. 99 — Excavation for piers at the north end is finished. Excavation for the south end is done and construction of abutment commenced. Bridge No. 102 — The south abutment is finished and the north abutment laid to the elevation of the bottom of piers. Bridge No. 103 — The piers at the south abutment are finished and foundation of the north end begun.

Contract No. 61.— For prism excavation, and construction of culverts, bridges, waste-weir, etc., between a point 0.5 mile west of Adam's Basin bridge and Monroe-Orleans county line.

The contractor began operations November 21, grubbing and clearing at a point about midway between bridges Nos. 110 and 111, on the south side. For 2,000 feet the new ditch is practically completed and the new embankment partially built.

Contract No. 9.— For prism excavation and structures between a point near Eagle Harbor and a point near Beal's bridge.

Lidgerwood excavator No. 1 has removed 30,238 cu. yds. during the month, while No. 2, working further west, has a record of 5,319 cu. yds. Road culvert No. 96 is practically finished, except pointing and putting in catch-basins. The north abutment

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of Allen's bridge is completed. Excavation has been started at culverts Nos. 91, 93 and 94. Embankment is being formed at road culvert No. 96, and west of Long's bridge.

Contract No. 64.— For improvement from 600 feet west of Prospect street bridge, Medina, to 100 feet east of Gasport bridge.

About 10 per cent of the clearing has been accomplished. Grubbing on the berme side has been done near Hurd's and west of Watson's bridges. At Williams' bridge on the south abutment the footing course of concrete has been laid and the road culvert under the proposed south approach has been completed. At Vernon street bridge, excavation for retaining walls has been started and part of the easterly walls of both approaches made. At Williams' bridge, at Hurd's bridge and west of Watson's bridge excavation and embankment forming has progressed, by wagons, wheel and slip scrapers and graders. A plant is in process of assembling near Gasport. Excavation at culverts Nos. 105, 108, 110 and 113 and at Maybee's waste-weir has been started.

Contract No. 66.— For prism excavation, constructing bridges and approaches, culverts, etc., from 100 feet east of Gasport bridge to 600 feet east of Lockport locks.

Work on this contract began November 2, 1,466 cu. yds. having been excavated at various points, mostly at Wakeman's bridge and in the near-by prism. About 500 cu. yds. of embankment were made in this locality, and 190 cu. yds. of concrete were placed in the retaining wall and at culvert No. 118. Two hundred cu. yds. of grubbing have been done. Materials for concrete are being delivered at all structures.

Contract No. 19.— For prism excavation, rebuilding bridges, constructing masonry culvert, concrete-capped pile docking, etc., between Sulphur Springs guard-lock and mouth of Ellicott creek.

The total excavation for the month was 17,326 cu. yds., distributed as follows: The cableway at Pendleton excavated 5,912 cu. yds., placing the material in adjacent spoil banks. The dipper-dredge *Buffalo* and the two clam-shell dredges excavated 10,514 cu. yds., the clam-shells acting as spoiling machines for the dipper. The Page bucket excavator moved 900 cu. yds. of material and for the remainder of the month constructed dikes. Excavation by present methods in Tonawanda creek has been abandoned. A hydraulic dredge is to be used for completion.

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At Pendleton bridge about 200 cu. yds. of concrete have been placed in abutment.

At Tonawanda dock 133,452 ft. B. M. of sheeting and bracing have been placed in coffer-dam.

Champlain Canal.

Contract No. 1.—For dredging Hudson river channel from Northumberland to Fort Miller and from Crocker's Reef to Fort Edward; constructing Crocker's Reef dam and approaches to "Land Line," etc.

The dredge *Peconic,* working double shifts, about three-quarters of a mile south of Fort Miller, has taken out about 2,600 cu. yds.

The rock-breaker is still operating on triple shifts near Fort Miller.

About 350 cu. yds. of wash-wall have been placed in the land line, 30 cu. yds. of stone filling in the breakwater pier, and about 110 cu. yds. of riprap around this pier.

Contract No. 3.—For excavating prism from Fort Miller to Crocker's Reef, constructing Lock No. 6, bridge foundations, etc.

On the original contract the work of trimming up slopes has been carried forward. Everything has been removed from the slopes except a small amount of rock to be taken out later. About 4,000 cu. yds. have been taken out in this way, and placed on the adjacent embankment to the extent of about 2,500 cu. yds.

The work of excavating the ditch north of the Ridge road for embankment material behind the lock walls was begun the 29th, and about 200 cu. yds. were removed.

Contract No. 26.—For dredging Hudson river channel between Fort Edward and north end of Contract No. 1.

The dredge has taken about 6,200 cu. yds. of material from the west side of the prism near Bradley's island.

The crib work at the bulkhead is nearly completed and partially filled by the aid of the dredge.

Contract No. 27.—For work between Dunhams Basin and Fort Edward, including Locks Nos. 7 and 8, junction lock, spillways, power plants, etc.

The revolving derricks are working in prism cut between East street and Baldwin avenue, with a record to their credit of

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73,000 cu. yds.; 12,000 cu. yds. have been placed in embankment at the bridge approaches. The graders in the prism north of Argyle street and in the New Bond creek channel have taken out 7,600 cu. yds. The dredge at Lock No. 7 has excavated and about 300 cu. yds. in bridge approaches.

Of concrete, 1,700 cu. yds. have been placed in Lock No. 8, and about 300 cu. yds. in bridge approaches.

Contract No. 25.— For prism excavation between a point 0.6 mile north of Comstock post-office and the highway crossing at Dunhams Basin; constructing Lock No. 9, spillways, power plant, etc.

The dredge *Fort Edward,* operating about half a mile south of Smith's Basin highway, removed 52,419 cu. yds. up to November 9. From the 10th to the 15th the dredge was occupied in passing various bridges, which were removed and replaced while the dredge was *en route* to Fort Ann, to dig north. The Champlain canal was cut by the dredge on the 15th and north of Fort Ann highway it has since excavated 69,484 cu. yds. The power excavators (towers), 1.3 miles south of Smith's Basin highway, excavated 12,315 cu. yds. from the canal prism and grubbed 781 cu. yds. Embankment to the extent of 2,747 cu. yds. was formed. The tower excavator on the by-pass south of Smith's Basin highway excavated 5,161 cu. yds. The tower excavator and the teams on the prism cut north of Comstock excavated 12,335 cu. yds., grubbed 1,507 cu. yds. and placed 5,246 cu. yds. in embankment.

Near old Lock No. 19 drilling, blasting and excavating rock and earth is in progress. About 2,693 lin. ft. of rock were drilled and 5,085 cu. yds. of rock excavated. At the syphon spillway, 120 piles and some triple-lap sheet-piling were driven; concrete was finished November 11; about 229 cu. yds. were laid.

Contract No. 15.— For prism excavation, and constructing Lock No. 11, Dam No. 4; Lock No. 12, Dam No. 5; spillway, culverts, highway, bridges and other structures between a point 0.6 mile north of Comstock post-office and Lake Champlain at Whitehall.

The dredge *Champlain* finished its work at the north end of the contract November 2d, and turning, moved south, cleaning up the prism. It repassed the railroad bridge on the 8th, cleaning up on the way. It excavated an opening in the coffer-dam north of old Lock No. 20 on the 13th; passed through and waited rebuild-

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ing of dam until the 23d, when it began pumping material to fill the interior. The pressure of water and spoil carried away a portion of the north side of the coffer-dam and the dredge again closed down for repairs.

At Lock No. 12, Whitehall, excavation for the crib below the lock was finished with difficulty and by running pumps constantly to keep down the water, permanent timber cribs have been framed and placed, using 27,750 ft. B. M. to date. About 250 cu. yds. of stone and gravel filling were placed in cribs. At the east wall 646 cu. yds. of blasted rock and earth have been removed. Forms have been built, sand from East Bay accumulated and other general work performed.

At Lock No. 11, Comstock, nearly 2,000 cu. yds. of concrete were laid, lock-valves and needle-beam at the north end were placed, forms built, sand sifted, lock pumped, 115 short piles driven and other general work performed.

Oswego Canal.

Contract No. 10.— For prism excavation, constructing Locks Nos. 2 and 3, dams, bulkheads, etc., at Fulton.

Excavation with the steam-shovel, north of the Oneida St. bridge was discontinued the first week in the month and the machine moved to the south end of the contract, where it began moving earth from the prism about the 15th. The excavated material is being used to construct the dike around Yelverton island. About 3,089 cu. yds. of rock from the north end and 4,516 cu. yds. of earth from the south end have been moved from the prism during the month.

Considerable excavation has been moved along the site of the left upper approach-wall to Lock No. 2. About 500 cu. yds. of earth were placed in coffer-dam. Some 160 lin. ft. of river wall and 80 lin. ft. of left approach-wall, all below Lock No. 3, have been constructed, using 513 cu. yds. of concrete in them.

The necessary rock and old masonry excavation was made for bulkhead No. 2, and 100 cu. yds. of concrete placed therein. This bulkhead is 75 per cent completed. In the left upper approach-wall for Lock No. 2, 230 cu. yds. of concrete have been placed.

In the upper dam 78 cu. yds. of concrete have been laid. Forms are being placed for a section of the auxiliary spillway between the east end of the upper dam and the new head-gates of the Oswego Falls P. & P. Co. (originally bulkhead No. 6), and for all

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walls heretofore mentioned. A coffer-dam has been constructed between the two existing locks, near the electric light plant, and also one is nearly finished across the old canal about 400 ft. farther south. The portion of the coffer-dam at the site of bulkhead No. 5 (west end of upper dam), has been puddled.

About $30,000 worth of work has been done by the contractors on the head-race and gates for the Oswego Falls P. & P. Co. This makes about $70,000 worth of work to date at this point. A part of this work was eliminated from the original contract under Alteration No. 1. As the building of this bulkhead is necessary before the upper dam is raised, its construction should be noted.

Contract No. 35.— For prism excavation, and constructing Locks Nos. 7 and 8, bulkheads, culverts, spillways, etc., between a point one-half mile above Utica street bridge and harbor line north of Bridge street bridge at Oswego.

At Lock No. 8, 1,683 cu. yds. of rock and old masonry were removed and selected for crushing. The dredge was changed from the lower to the upper level and removed 1,296 cu. yds. of material, which was placed in coffer-dams between the race and the site of Lock No. 7. This coffer-dam, together with the one in the hydraulic race, is well advanced. The coffer-dam south from the Utica St. bridge is finished.

Nearly 2,000 cu. yds. of concrete were laid in the lower part of Lock No. 8. A steam-derrick has replaced an electric one and stone crushing and delivery of material has been in progress.

Water-Supply.

Contract No. 55.— For constructing Delta reservoir, including the clearing of the site, the construction of a dam, the relocation of 1.9 miles of Black River canal, with four locks and aqueduct over Mohawk river, highway change, bridges, etc.

Preparations for assembling plant are in progress.

Progress of Plans Being Prepared.

The following pages show the status of the plans in preparation at the main and residency offices, to the first of December. An order according to location is followed, as explained in the account of contract work for the month.

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Erie Canal.

Contract No. 32.— For lock-gates, needle-dams and valves, on contracts Nos. 3, 25 and 27. Plans 90 per cent completed.

Contract No. 42.— For prism excavation, and construction of Lock No. 20, stream entrances, spillway, bridge and other structures, between Herkimer-Oneida county line, near Utica, and Oriskany. Plans 75 per cent completed.

Contract No. 43.— For work between Oriskany and Contract No. 4. Plans 60 per cent completed.

Contract No. 22.— Bridges on Contract No. 12. Plans 50 per cent completed.

Contract No. 57.— Syracuse Harbor. Plans 99 per cent completed.

Contract No. 48.— For prism excavation, and building of structures from a point near the N. Y. C. & H. R. railway crossing at Lyons, to the N. Y. C. & H. R. railway crossing east of Palmyra. Plans 99 per cent completed.

Contract No. 49.— For excavating prism and building structures from the N. Y. C. & H. R. railway crossing east of Palmyra to the Wayne-Monroe county line. Plans under way.

Contract No. 63.— For work between the Wayne-Monroe county line and Kings Bend, west of Pittsford. Plans 70 per cent completed.

Contract No. 23.— For prism excavation, constructing Locks Nos. 32 and 33 and appurtenant structures, culverts, bridge foundations, etc., between Kings Bend and east bank of the Genesee river. Plans completed, but withdrawn, pending decision as to location south of Rochester.

Contract No. 21.— For prism excavation and constructing bridge foundations, etc., between a point just north of Scottsville road and another point just south of Buffalo road and south of Rochester, dredging Genesee river, constructing guard-lock and

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controlling dam at Genesee river crossing. Plans withdrawn, pending decision as to Contract No. 23.

Contract No. 65.— For work from the west end of Contract No. 9, at a point near Beal's bridge, to the east end of Contract No. 64, at a point 600 feet west of Prospect street bridge, Medina, including aqueduct at Oak Orchard creek crossing. Plans 90 per cent completed.

Contract No. 67.— For construction of Locks Nos. 34 and 35, and approaches, etc., at Lockport. Plans 50 per cent completed.

Champlain Canal.

Contract No. 69.— For constructing Lock No. 1 and Dam No. 1, above Waterford; and Lock No. 2 below Mechanicville. Plans transmitted to Advisory Board, December 2, 1908.

Contract No. 70.— For dredging in the Hudson river from Waterford to Northumberland. Plans 90 per cent completed.

Contract No. 56.— Glens Falls Feeder. Work on plans suspended.

Oswego Canal.

Contract No. 39.— For dredging channel in Oswego river, constructing stream entrances, excavating through Hinmansville cut-off, etc., between Phœnix and Oswego, except portions covered by Contracts Nos. 10 and 37. Plans 80 per cent completed.

Contract No. 37.— For constructing dams and other structures between Three Rivers and Oswego, except in the portions covered by Contracts 10 and 35. Plans under way.

Water-Supply.

Contract No. 50.— For constructing dam, waste-gates and spill-way across West Canada creek at Hinckley. Plans 90 per cent completed.

Contract No. 51.— For constructing a diverting dam and feeder to Nine Mile creek watershed. Plans under way.

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Plans Before Advisory Board.

Contract No. 30.— For dredging channel in Mohawk river and land line from Little Falls to Sterling creek, constructing lock at Jacksonburg, dam and guard-gate at Herkimer, bridges, stream entrances, etc. Plans transmitted to Advisory Board December 3, 1908.

Contract No. 29.— For excavating prism from Sterling creek to Herkimer-Oneida county line, constructing lock at Sterling creek, bridges, stream entrances, etc. Plans transmitted to Advisory Board, December 2, 1908.

Contract No. 62.— For prism excavation and construction of culverts, bridge substructures, etc., between Orleans-Monroe county line and a point near Eagle Harbor bridge. Plans submitted to Advisory Board, December 2, 1908.

Contract No. 24.— For constructing guard-gate at Crocker's Reef. Plans ready for Canal Board.

Contract No. 28.— For constructing an apron at Crocker's Reef dam. Plans ready for Canal Board.

Ready for Letting.

Contract No. 36.— Operating winches for movable dams. Plans approved by the Canal Board, November 24, 1908, and specifications, etc., now in the hands of the printer.

Contract No. 38.— For constructing substructure, superstructure and approaches at Wapping's bridge. Specifications, etc., in the printer's hands.

Contract Advertised.

Contract No. 20.— For dredging a channel in the Mohawk river and performing work incidental thereto between Rexford Flats and Little Falls. Length, 58.7 miles. Advertised. Bids to be opened December 22, 1908.

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Recapitulation—Progress on Plans.

Contract No.	DESCRIPTION.	Canal.	Progress on plans.
20	Rexford Flats to Little Falls	Erie	Bids to be opened Dec. 22, 1908.
21	Genesee river, west 2.56 miles	Erie	Suspended, pending decision.
22	Bridges on Contract 12	Erie	50 per cent completed.
23	Kings Bend to Genesee river	Erie	Withdrawn, pending decision.
24	Guard-gate at Crocker's Reef	Champlain	Ready for Canal Board.
28	Apron, Crocker's Reef dam	Champlain	Ready for Canal Board.
29	Sterling creek to Herkimer–Oneida line	Erie	Before Advisory Board.
30	Little Falls to Sterling creek	Erie	Before Advisory Board.
32	Lock-gates, needle-dams and valves on Contracts 3, 25 and 27	Erie and Champlain	90 per cent completed.
36	Operating winches for movable dams	Erie	Ready for letting.
37	Three Rivers to Oswego — structures, except on 10 and 35	Oswego	Plans under way.
38	Wapping's bridge	Erie	Ready for letting.
39	Three River Point to Oswego—dredging	Oswego	80 per cent completed.
42	Utica to Oriskany	Erie	75 per cent completed.
43	Oriskany to Contract 4	Erie	60 per cent completed.
48	Lyons to Port Gibson	Erie	99 per cent completed.
49	Port Gibson to Wayne–Monroe line	Erie	Under way.
50	Hinckley reservoir—water-supply	Erie	90 per cent completed.
51	Nine Mile Creek diversion, dam and feeder	Erie	Under way.
56	Glens Falls feeder	Champlain	Work on plans suspended.
57	Syracuse harbor	Erie	99 per cent completed.
62	Monroe–Orleans line to Eagle Harbor bridge	Erie	Before Advisory Board.
63	Wayne–Monroe line to Kings Bend	Erie	70 per cent completed.
65	Aqueduct and bridges at Medina	Erie	90 per cent completed.
67	Lockport locks	Erie	50 per cent completed.
69	Lock and dam above Waterford and lock below Mechanicville	Champlain	Before Advisory Board.
70	Dredging, Waterford to Northumberland	Champlain	90 per cent completed.

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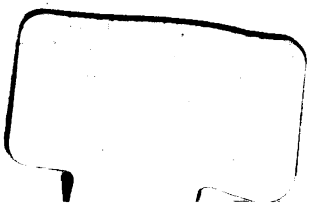

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